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EMPIRE COTTON GROWING CORPORATION.

REPORT OF THE ADMINISTRATIVE COUNCIL OF THE CORPORATION SUBMITTED TO THE NINTH ANNUAL GENERAL MEETING ON MAY 29th, 1930.

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EMPIRE COTTON GROWING CORPORATION.

Annual Report.

FOR THE SEASON

1928-1929.

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REPORT OF THE ADMINISTRATIVE COUNCIL OF THE CORPORATION TO BE SUBMITTED AT THE NINTH ANNUAL GENERAL MEETING ON MAY 29TH, 1930.

Following the practice of last year, an attempt has been made in the present Report to summarise in all its aspects the work that has been carried out by the Corporation during the past year. In view of the fact that by adopting this course a certain amount of matter has to be included with which members of Council have already been familiarised through the medium of the Quarterly Reports issued by the Executive Committee, the argument for so doing, as given in last year's Report, may perhaps here be repeated. The Annual Report necessarily has a wider circulation than the Quarterly Reports, and even to those who receive the latter, it is sometimes convenient to have at hand a synopsis of the whole year's work.

The Directors of Agriculture of the several cotton-growing countries have again been kind enough to supply notes on the prospects of the current cotton season in their respective areas, so that the Report is brought as far up to date as possible in the light of the information that has thus been supplied.

Personnel.

During the past year the Corporation have had to record with regret the death of Mr. G. B. Zochonis, one of the representatives on the Council of the British Cotton Growing Association. Mr. Zochonis took an active share in the work of the Association from its foundation, and his death is a severe loss both to that body and to this Corporation.

The news of the death of Mr. J. W. Ogden, J.P., will have been received with widespread regret. Mr. Ogden had been the representative of the Amalgamated Weavers' Association on the Council of the Corporation since the grant of the Charter in 1921, and was a regular attendant at their meetings.

The Council noted with the greatest pleasure in the New Year's Honours List the promotion of Mr. W. C. Bottomley to K.C.M.G. In conveying to him a message of congratulation on this recognition of his work, the opportunity was taken of placing on record the appreciation of the Corporation of the ready assistance which he had rendered in furthering the objects of the Corporation, both as the representative on Council and on the Executive Committee of the Colonial Office, and as a member of the Empire Cotton Growing Committee of the Board of Trade, the body on whose report the Corporation was established.

It was also noticed with pleasure that the honour of C.I.E. had been conferred on Mr. B. C. Burt, Expert Adviser to the Imperial Council of Agricultural Research in India, and formerly Secretary of the Indian Central Cotton Committee.

The Corporation were gratified to hear that the Secretary of State for the Colonies had selected Mr. R. H. Jackson, Chairman of their Executive Committee, as one of the members of the Advisory Committee on Colonial Development, of which Sir Basil Blackett is Chairman.

The Colonial Office have nominated Mr. G. H. Creasy Secretary of the Colonial Advisory Council of Agriculture, in place of Mr. Boyd, to accompany Sir Cecil Bottomley at meetings of the Executive Committee and of the Administrative Council.

During the past year, agricultural science has suffered a great loss by the death of Professor T. B. Wood, F.R.S., Professor of Agriculture at Cambridge. From their early days the Corporation have owed much to the assistance which Professor Wood gave, as a member of their Research and Training Sub-Committee, in the formulation of their scheme of post-graduate Studentships, and in drawing up their plans for organised research work on cotton. Professor Wood was also good enough to serve as a member of the small Committee for the selection each year of candidates to whom Studentships should be awarded.

It is a matter of especial satisfaction to the Corporation that Mr. F. L. Engledow was elected to the Professorship of Agriculture in succession to Professor Wood.

Professor Engledow has personally supervised the work of those holders of the Corporation's Studentships who have spent a year at Cambridge, and he has also taken a large share in the organisation of the post-graduate courses in Agriculture at Cambridge with a view to meeting the varied needs of those men who go to the University to take advanced studies in this subject. He has also given invaluable assistance in the task of selecting the Corporation's Students. Further, members will doubtless remember the interesting report on cotton-growing in Nigeria which he wrote in conjunction with Colonel French after their visit to that country in 1928, while his visit last year to the Corporation's Research Station in Trinidad is referred to later in this report. In congratulating Professor Engledow on his election, the Corporation can but regret that his new duties will inevitably prevent him from giving

the same close personal supervision to their Students as in the past, but they are glad to know that they will be able to retain his advice and assistance as a member of their Research Station and Studentship Selection Committees.

Sir John Farmer, F.R.S., has retired from his post of Professor of Botany and Head of the Biological Laboratories at the Imperial College of Science and Technology, with which he has been associated since 1892. The Corporation have been fortunate in having been able to avail themselves of Sir John's assistance and advice on innumerable occasions in connection with the training of students, and especially with the work of their Research Station in Trinidad. It is consequently a source of the greatest gratification to them that he has consented to continue a member of their Studentship Selection Committee and of the Research Station Committee, on both of which his services are of the utmost value. Professor V. H. Blackman, F.R.S., who has succeeded Sir John Farmer at the Imperial College, has been good enough to consent to join the Corporation's Research Station Committee.

Levy.

When the Cotton Industry Act was renewed in 1928, it was thought advisable to provide a means whereby the rate of levy payable by spinners could be reduced from the standard rate of 3d. for every 500 lbs. of cotton purchased, if such a course seemed desirable. Power was accordingly given to the Corporation in the Act to reduce the rate in respect of any year of the period for which the Act remains in force, with the approval of the Board of Trade.

When the Corporation's budget for the year 1930–31 was under consideration, the Director was asked if he could foresee any directions in which considerable new expenditure ought to be, or might possibly be, incurred next year, even if they were not then sufficiently definite to allow of their inclusion in the budget. His reply being that he had no proposals

to submit which would entail considerable new expenditure, it appeared to the Executive Committee that the revenue which would in all probability be forthcoming if the levy were maintained at 3d. per 500 lbs. would exceed that required next year to meet the Corporation's estimated expenditure. In these circumstances, they did not feel justified in asking the spinners to maintain their contribution at this rate at the present time, and, the Board of Trade having given their approval, it was decided to reduce the levy to the rate of 1d. per 500 lbs. of cotton purchased as from July 18th, 1930, which is the beginning of a year from the date upon which the Cotton Industry Act was passed. The reduction will be effective for twelve months from the date named, at the end of which time the question will be reconsidered.

The Executive Committee wish to make it clear to all those who may read this Report whether at home or overseas that this decision does not imply any curtailment of the Corporation's activities, and that there has been no question of cutting down the budget to meet the smaller income anticipated. It is not, indeed, expected that the reduced income will provide for the whole of the probable expenditure in 1930–31 ; there will almost certainly be a deficit, but this will be met from the reserves that have been accumulated in the past years. This accumulation of reserves has been rendered possible by reason of the fact that in the early years of the Corporation's history, the levy was at the rate of 6d. per bale, whereas, to begin with, while the lines which the Corporation's policy should follow were being considered and laid down, the expenditure was naturally considerably less than the present figure. Moreover, even if complete schemes for the development of cotton-growing had been formulated prior to the formation of the Corporation, and had merely been awaiting that event in order to be put into action, the lack of men with the necessary qualifications and experience for staffing such projects would have rendered it

impossible in the early years to embark on many promising lines of work which have since been undertaken as adequate staff became available, largely recruited from men who had received the course of post-graduate training provided by means of the Corporation's Studentship Scheme.

Within the last two or three years, moreover, it has been found possible to reduce expenditure in some directions, partly owing to the increasing share that Colonial Governments are now taking in the cost of developing cotton-growing, and also because the scheme of Agricultural Scholarships instituted by the Colonial Office for training recruits to the Colonial Agricultural Service on lines similar to those initiated by the Corporation, has enabled the number of Studentships awarded by the Corporation to be proportionately cut down.

In these circumstances, the Committee were fortunately able, when approaching the Board of Trade for their approval to a reduction of the levy, to state with the fullest confidence that the present scope and efficiency of the Corporation's work would not suffer thereby.

India.

The inauguration by H.E. the Viceroy in July, 1929, of the Imperial Council of Agricultural Research was an event of no little significance in the history of India's agricultural progress. It will be recalled that the formation of this body was one of the principal recommendations of the Royal Commission on Agriculture in India. The Imperial Council has been entrusted by the Government of India with the formulation and execution of schemes of research appertaining to all branches of agriculture in India, in pursuance of the suggestion made by the Royal Commission. The Vice-Chairman of the Imperial Council of Agricultural Research is ex-officio President of the Indian Central Cotton Committee, and the Expert Adviser in agricultural matters to the Council is also ex-officio

a member of the Cotton Committee, thus ensuring close contact between the two bodies.

Mention was made last year of the decision to reduce with effect from the 1st July, 1929, the basis of the Empire Futures Contract in the Liverpool Cotton Exchange from "strict low middling" to "low middling." This provision is now in force and has proved beneficial to the trade in Indian cottons. Further measures with the same object in view have since been formulated by the Federation of Master Cotton Spinners Associations, which has asked the Indian Central Cotton Committee for its co-operation with a view to improving the quality of Indian cotton and increasing the use of it in England in the following directions: (*a*) by setting up definite and reliable universal standards of grades or types of Indian cotton; (*b*) by setting up in co-operation with Bombay, Karachi, etc., an official type of deferred delivery contract; and (*c*) by taking such action as may be possible to combat the practice of mixing "desi" cotton with good types, particularly with Punjab-American. Through the courtesy of the Board of the East Indian Cotton Association replicas of official standards were prepared and sent to Manchester. It was also arranged to send boxes of Sind cotton when the East Indian Cotton Association prepare their official standards at the beginning of the cotton season. It was felt by the Indian Central Cotton Committee that there should be no difficulty in selling on an extended contract in Lancashire, and that any large exporting firm in Bombay or Karachi would be prepared to undertake such business. With regard to (*c*) the Federation was informed that the Committee in co-operation with trade associations, local Governments, and other bodies was giving its fullest consideration to the question of mixing and to the means whereby this malpractice might be checked.

The improvements that have taken place in Indian cotton, particularly in the direction of longer staple and better

grading and marketing, have naturally resulted in Indian cotton becoming more widely known in the European markets. The increase in the Continental consumption of Indian cotton may be gathered from the following table :—

RUNNING BALES 000's.

1926–27.		1927–28.		1928–29.		1929–30.	
1st half.	2nd half.	1st half.	2nd half.	1st half.	2nd half.	1st half.	—
475	380	442	520	565	585	685	—

The increase in the United Kingdom consumption of Indian cotton is not less striking :—

RUNNING BALES 000's.

1926–27.		1927–28.		1928–29.		1929–30.	
1st half.	2nd half.	1st half.	2nd half.	1st half.	2nd half.	1st half.	—
48	34	47	74	92	91	100	—

The progress indicated by these statistics is highly satisfactory and points to the conclusion that the demand for Indian cotton in the world's markets is increasing. In this connection it may be noted that Russia imported 52,000 bales of Indian cotton during 1929, and that this is her first appreciable purchase of cotton from India since the War.

The completion of the Sukkur Barrage in Sind will result in a considerable increase in the area under cotton cultivation in India. The problems that await solution in Sind are many and varied. So far back as 1927 the Indian Central Cotton Committee initiated a research scheme for Sind. The object of this scheme is to investigate certain problems connected with the water requirements, sowing dates and general physiology of the cotton plant under perennial irrigation. The work is

being carried out in anticipation of the change-over in Sind from inundation to perennial canal irrigation under the Lloyd Barrage project. The chief obstacle in the past to the growing of long-staple cotton in Sind was the precarious and short water supply. The supply of perennial water will alter the whole practice of the province, and will give a chance to Egyptian and American varieties. Experiments have shown that the long-staple exotics fall behind the more hardy short staple cottons in yield, and the Agricultural Department is at present concentrating on the breeding of a hardy and prolific variety of long-staple cotton by selection and acclimatisation and by hybridisation with the 4F. Punjab variety. The physiological part of the work is being financed by the Indian Central Cotton Committee.

The fifth official forecast of the Indian Cotton Crop for 1929–30 gives an estimated area of 25,692,000 acres as against 27,053,000 acres, the revised estimate at this date last year, or a decrease of 5 per cent. The total estimated yield now stands at 5,260,000 bales of 400 lbs. each, as compared with 5,811,000 bales (revised) at the corresponding date last year, or a decrease of 9 per cent. The condition of the crop is reported to be fair on the whole. In Bombay the crop showed healthy development in the beginning, but suffered subsequently on account of deficiency of rain during the period of growth, intense heat in October, and severe locust damage in October and November. In the Punjab and Madras the weather conditions were approximately similar and caused a certain amount of damage. Information regarding the late crop in certain districts, chiefly in Madras, Bombay, and Hyderabad, was not complete at the time when this Report had to be prepared.

Australia.

When the last Annual Report was written, the Cotton Specialist to the Queensland Government foreshadowed a

considerable falling-off in the crop for 1928–29, owing to the bad season. As matters turned out, the season continued as badly as it had begun. The rains were extremely late, so that in many parts of Queensland the crop could not be planted until December, and heavy rains in the first half of April destroyed any prospect there might have been of anything more than extremely small yields. Finally, in the last half of that month, very heavy frosts occurred, so that most of the top crop was frozen through. The experience of last season has, it is stated, impressed growers with the necessity of early and thorough preparation of the seed bed so as to ensure, if possible, a successful strike after the first planting rains. Fortunately, in every district where cotton is grown to any extent, there were certain areas which received early local showers, and in those parts, if the farming had been good, early strikes were obtained, resulting in satisfactory yields in such cases. These instances were, however, comparatively few, and the total crop for the season 1928–29 was about 6,000 bales as compared with over 10,000 bales in the previous year.

On the Experiment Station at Biloela the season was even more unfavourable than in many of the surrounding districts, as such slight showers as fell in September and October within a few miles missed the Station altogether. Most of the experiments were in consequence robbed of the greater part of their interest, owing to the loss of their yields ; wherever possible, however, information has been collected and correlated on such factors as plant growth and flower counts. At all events, the results showed the advantages of early planting —one of the chief of which is, apparently, that the corn-ear worm, undoubtedly one of the most serious pests to the Queensland cotton grower, is particularly destructive to late-planted cotton, whereas the early maturing crop is comparatively free from any severe attack. In spite of the adverse conditions, the progeny material derived from the breeding plots is stated to have been the best collection since the work

was started. It was characterised by exceptional strength of fibre, and the authorities consequently hope that they are at last making headway in overcoming the lack of strength which the Durango variety has shown in the past under bad seasonal conditions.

Writing in March last the Cotton Specialist reported that the prospects for the season 1929–30 were then rather uncertain. With the exception of a few of the smaller districts, the development of the plants had been backward, due to a combination of somewhat late planting, deficiency of rainfall up to Christmas time, and, in some areas, severe attacks by the corn-ear worm In the last fortnight of January, however, unusually heavy rain fell in practically all of the cotton-growing districts and the soil was thoroughly moistened to a depth of at least 12–18 inches. In February a period of cool nights and hot days caused a promising top crop to develop If the dry weather lasted during April, the crop prospects were decidedly favourable and an estimate of 3,500,000 lbs. of lint is probably fairly conservative.

Sufficient seed was issued to plant around 33,000 to 35,000 acres, and it is probable that 30,000 to 31,000 acres are now in varying degrees of development.

South Africa.

The Director, Sir James Currie, and the Chairman of the Finance Committee, Mr. Arthur Foster, are at present on a visit of inspection to South Africa and Rhodesia.

Last season's work in South Africa has been a continuation of the development of a supply of cotton seed suitable to the Low Veld. It will be remembered that this was the task entrusted to the Corporation by the Union Government in 1924. It at once appeared that the principal objective must be the production or importation of a variety resistant to the jassid pest, and it is along the former of these lines that the work has continued. The most successful strain, known as

Barberton U.4, was bred from a single plant in 1924–25. During the season 1928–29, an area of about 1,500 acres was planted in the Union with the seed from this plant, and in spite of a late season, drought, and in some cases bollworm, U.4 fully confirmed the favourable impressions that had been formed of it in past seasons. Although selected primarily on account of its jassid-resisting properties, it possesses other valuable qualities which render it particularly suitable to climatic and other conditions, not only in the Union, but in other parts of Africa as well. It shows remarkable resistance to drought, prolific flowering capacity, quickness in forming buds and setting fruit, and is markedly less susceptible than many other varieties to shedding of either buds or bolls. Moreover, in the bulk, which is still far from being uniform, there is a large number of individual plants with excellent lint characters and a high ginning percentage. Last season, in places where the conditions were really good, yields of 1,000 to 1,500 lbs. of seed cotton per acre were not unknown, while under average conditions a crop of 750 lbs. per acre should normally be obtained. It may be remarked that hitherto a "bale" of seed cotton (450 lbs.) had been accepted as the standard of a good crop in the Union, so the new variety shows a marked advance in this respect.

An account of the climatic conditions under which the 1928–29 crop was grown was given in last year's Report up to March. It was there mentioned that rains had been very late, but that there was promise of a satisfactory crop notwithstanding, since the resistance of the variety U.4 to jassid gives the plant a much better opportunity of producing a good late crop than was the case with susceptible varieties. This promise was partially fulfilled, at all events in the principal areas in which U.4 was grown. Towards the end, the season proved more favourable than might have been expected, the warm weather continuing later than usual, and U.4 gave good yields in nearly all places. As a result, nearly 300 tons of

bulk seed of this variety were obtained, which it was calculated would be sufficient to plant about 30,000 acres at the usual rate of 20 lbs. an acre. On the other hand, the total crop from the Union as a whole showed a falling off as compared with the previous season. The drought experienced from December until February, coupled with hot winds, caused considerable shedding, while bollworm attacks were severe in some districts.

The Corporation's Experiment Station at Barberton has been considerably developed during the past season. The laboratories have been finished and equipped, and the line for electric current has been installed. Electric power will be used both for pumping water from the wells and for running two small gins. The quarters for the staff are completed and occupied. Two larger houses and two smaller have now been built, and one smaller one purchased, all being near together in one group. The provision of houses for the staff within a convenient distance of the Station has naturally greatly facilitated the work, especially at busy periods.

Further re-selection work on U.4 has been carried on, and a number of newer selections gave excellent results, yielding from 1,400 to 1,700 lbs. of seed cotton per acre, with lint of good length and quality.

Now that it has been possible to meet urgent requirements for seed of a jassid-resistant variety, the Corporation have been able to devote more attention to the important question of suitable rotation crops. The experience of the past few seasons has enabled the limits to the time suitable for planting cotton in the Low Veld to be fairly definitely ascertained, and other quick-growing, early-maturing crops are required, particularly for the late seasons. As a result of experimental work at all the Corporation's Stations, evidence has been collected that two varieties of beans, sunflowers, and, in some districts, groundnuts, are all promising rotation crops. The next step will be to subject them to such thorough tests as to the optimum spacing, best times of planting, and so on,

as have already been carried out with cotton, and a good start has been made on these lines in the present season.

Meanwhile the Corporation have instituted enquiries in this country as to the market value of the beans and of the sunflower seeds, and as to the time of year at which they should arrive in order to command the best prices.

The analyses of the beans which the Imperial Institute have kindly carried out have shown their food value to be satisfactory. The Empire Marketing Board and certain firms of importers have also been good enough to supply much useful information as to their marketing, which has been communicated to our staff in Africa who report that, with somewhat higher yields than have been obtained so far, they should prove an attractive crop to farmers as a rotation to cotton, either for local markets or for export.

Enquiries are also being made as to the market for sunflower seeds, which appear to be more readily saleable on the Continent than in the United Kingdom.

The principal insect problem that still awaits solution appears to be the control of bollworms, more particularly American bollworm and the Sudanese bollworm. Trap crops of ratoon cotton have proved partially successful, and it is a hopeful sign that U.4 has shown itself capable of making a remarkably quick recovery from bollworm attack. Light traps for the moths are also still under trial.

The season 1929–30 had a good start, so far as planting rains were concerned. Hail did some damage in the Transvaal, but missed the Corporation's Cotton Breeding Station at Barberton. The descriptions of the season from the principal districts, written in the first week of March, are as follows :—

Transvaal, Low Veld.—" The season opened well with good early rains which facilitated the preparation of the land and gave plenty of time for planting full acreages in good time. Later rains have been generally good, and in very few places

has the crop been affected by drought. Early growth was checked somewhat by low temperatures, but the crop has developed very rapidly in the last two months, and the general condition now (March 3rd) is excellent. Heavy flowering has been going on for some time, and in many cases the crop of bolls already set is considerable and very early pickings are expected. Bollworm has been little in evidence and has not caused any serious loss generally, though in a few places the American bollworm took most of the early crop. The returns of the Barberton ginnery indicate a doubling of the acreage planted last year. Almost the whole of the cotton planted in the area is U.4, and the production should be more than double that of last year."

Northern Natal.—" A very considerable reduction in the acreage under cultivation in the Magut area has resulted this season from the liquidation of Candover Estates Ltd. Practically the whole of the land worked last year by this Company has had no cultivation since the passing of the Liquidation Order.

" The behaviour of the small multiplication blocks in the district last season of the U.4 strain decided growers as to its superior yielding powers. The only cotton planted this season was U.4, without a single exception, and some 4,500 acres of a reasonably good stand have been obtained in the Magut and Mkusi areas.

" The season opened early with exceptionally good rains in September, and the bulk of planting was completed by the end of October. The fact of the September rains being sufficiently good for planting, combined with smaller rains at fairly frequent intervals during October, has resulted in very much better stands being obtained than in former seasons. In some instances, chiefly later plantings, a certain loss of stand occurred subsequently from beetle damage. A dry spell in late November and December gave that set-back which seems

to force the cotton bush into fruiting. A heavy rain in mid-January followed, since when conditions have been inclined to dryness. Generally speaking, the response of U.4 to these conditions has been good, and a fairly early crop is in view. Grades should show a considerable improvement on those obtained last year. In most cases insect damage has been slight in comparison with that experienced in previous seasons."

Reviewing the cotton-growing areas generally, Mr. Milligan was able to report at the end of March that there was every indication of a satisfactory and early crop of good grade. The season had then been generally favourable, save for the rather severe attacks of American bollworm which occurred in most districts from mid-December to mid-January, and are referred to specially in the section dealing with Swaziland below. But the U.4 strain, which forms the greater part of the cotton grown this year, set another good crop after the attack, and this cotton, although later than it would otherwise have been, should have ample time to mature.

Swaziland.

A description of the season 1928–29 up to February was contained in last year's report. Owing to drought in the early months of the season, most of the early-planted cotton failed, and re-planting in November and December was general, while in the Southern part of the country, owing to continued lack of rain, the crop was re-planted as late as after Christmas. From February onwards conditions were exceptionally good, and the season, though late, was very much better than had been hoped. Heavy late pickings were obtained and the yields were generally highly satisfactory.

The assistance of farmers was enlisted to secure the rapid multiplication of the jassid-resistant variety, U.4. The seed was distributed in lots of 15 lbs. and upwards for planting at the low rate of 5 to 7 lbs. per acre, and the care that was

exercised in this work is illustrated by the fact that the 1,100 lbs. available resulted in the production of 38 tons of seed, a multiplication ratio of 77. The distribution of the multiplication blocks in different parts of the country has enabled most growers to see the behaviour of this strain in their own district, with a result that the demand for seed for the present season exceeded the supply available locally. It was fortunately possible to purchase the balance from Barberton district, so that the requirements of all growers have been met, and U.4 is almost the only variety now being grown in Swaziland.

The lowest yield obtained from the multiplication blocks last season was over 500 lbs. of seed cotton per acre, while the highest was 1,641 lbs. per acre, from a 15-acre block.

The seed returned by the several growers whose cotton was ginned at the Bremersdorp ginnery showed that on 87 acres the average yield was 1,066 lbs. of seed cotton per acre.

The cropping possibilities of this strain are illustrated by the fact that on one block of 39 acres, where the seed rate used was only 6½ lbs. per acre, the total rainfall for the year was 14·27 inches, of which 2 inches fell nearly three months before the crop was sown, so that the available rainfall was only about 12 inches. In spite of this, however, the yield obtained was 813 lbs. of seed cotton per acre.

Experimental work was continued, and some of the selections from U.4 showed an advance on the parent strain in uniformity, lint length, yield and ginning outturn.

The important question of rotation crops for cotton has received full attention : sunflower, groundnuts and beans have all given yields which, if confirmed on a large scale, would make them profitable crops, notwithstanding the heavy transport costs. Moreover, the lateness of the planting rains last season showed that, even when planted late in the season, these crops can still mature and give satisfactory returns. In addition, in a season of early rains, the land can be green

manured and the green crop ploughed under in time to allow of the rotation crop chosen being planted with a good chance of success.

The Experiment Station has proved too small for the work, and a further 24 acres have been leased on good, level land.

As regards the prospects for 1929–30, the following is an extract from a report despatched early in March :—

" The major portion of the cotton area was planted with U.4. The season opened with good general rains early in September, which continued throughout October, and from the middle of that month onward planting was general. By the middle of November the greater part of the crop had been planted, and good germination was reported from all areas. From November up to the time of writing, the rainfall throughout Swaziland, with the exception of two districts, has been ample for the requirements of the crop. The two districts referred to are Ingwavuma in South Swaziland, and part of the Black Umbeluzi area in North Swaziland. In the Ingwavuma district the rainfall from November to the middle of January was very light, and although plant cotton received a severe check, the main damage was done to ratoon cotton which had put on a heavy vegetative growth in the early part of the season. Part of the Bremersdorp area suffered considerable damage from a severe hailstorm on December 7th, followed by heavy rains on the 8th and 9th, reducing what had been perfect stands to very thin stands. The recovery of the hail-damaged cotton has been exceptionally good in most cases, due in no small measure to the equable growing conditions during the succeeding few weeks. It also afforded a remarkable demonstration of the powers of recovery of the U.4 strain after any set back. Low temperatures, along with fairly wet conditions, rather retarded the growth and fruiting of the crop in the early part of the season in Middle Veld areas, but a dry hot spell from mid-January to well on in February has enabled the crop to make up for lost time.

" Severe infestations of American Bollworm have been present in all early-planted cotton since December, resulting in the loss of most of the early squares and bolls. Heavy rainfall during the infestation has in some cases produced rather overgrown crops carrying few bolls, but there is ample time for the early planted cotton to produce a heavy late crop, provided moisture conditions remain good. During the last fortnight of February little bollworm activity has been noted, and this, coupled with good general rains in the last week, warrants an optimistic outlook.

" Regarding the work that is being carried out on the Experiment Stations, most of the cotton tests laid out on the Bremersdorp Station were destroyed by the hailstorm on 7th December. Fortunately observation plots of the most recent U.4 single plant selections were put out on a number of farms in different areas, and their behaviour up to date has shown a marked improvement over the original bulk."

Southern Rhodesia.

In last year's report a summary was given of the work that had been carried out in Southern Rhodesia since the establishment of the Plant Breeding Station at Gatooma. It will be remembered that the local varieties of cotton had practically entirely succumbed to attack by jassid, and hardly any cotton has been grown in the country in consequence since 1926. A stage has now been reached at which it is believed that cotton-growing is about to be once more launched on a commercial scale, but based this time on surer foundations that have been rendered possible by the breeding by the Corporation's staff of a jassid-resistant variety.

In the season 1928–29, the 1-ton of U.4 seed which was available at the beginning of the season was converted into 65 tons through the whole-hearted co-operation of farmers who agreed to sow at a low seed rate, and to pay special attention to the cultivation of the crop in order to achieve the maximum

possible multiplication of seed. This multiplication rate is in itself satisfactory, and is all the more so in view of the extremely trying climatic conditions of the season 1928–29. The difficulties of the early months were described in last year's Report, but in spite of them, Mr. Cameron was able to report at the end of March that the crop had made good progress, and promised to bear heavily. The difficulties were not at an end, however. In April, unfortunately, there was a particularly severe attack of American bollworm, which developed first on the maize and subsequently spread to the cotton as the maize ripened. Of the various strains that were being grown experimentally at the Cotton Breeding Station, U.4 alone, being a prolific, small-bolled type, was able to set a fair crop. Bollworm attacks have been neither severe nor frequent in the last few years, and the lesson to be drawn from last season's experience is the necessity for concentrating on the selection of still more prolific and earlier maturing strains. The Report from the Gatooma Station published in the Corporation's annual volume of Experiment Station Reports, shows that such strains exist in the material available, and selection work on them is being carried out at Gatooma. In addition, the experience in the multiplication of U.4 last year shows that there will be no difficulty in the multiplication of any superior strains that may be issued from Gatooma as a result of the selection work.

It is fully recognised that the U.4 bulk seed that has been issued for planting in the season 1929–30 is still far from purity. In addition to this variety, however, small quantities of seed from specially selected plants of high-yielding qualities were sold in 10 lb. packets. A high price was charged for this special seed, but, even so, the demand for it far exceeded the supply, with the result that eventually it was found necessary to allot the seed by ballot. Further propagation of this selected seed will be most helpful in improving the seed stocks in those parts of the country in which it is being grown, as it

is estimated that the seed from one of the special packets should give sufficient in the following year to plant about 100 acres. 124 such packets of selected seed were issued in the season 1929–30, so that next season there should be enough to plant upwards of 10,000 acres, while at the same time there should be sufficient U.4 ordinary bulk available to plant 200,000 acres. It is not anticipated that such an area will be planted for a number of years yet, but the figure is mentioned as illustrating the rapid rate of seed multiplication that has been achieved.

At the Gatooma Station the work has naturally increased considerably, and the area under cultivation has also been extended. In these circumstances, the Corporation appointed Mr. A. N. Prentice, a former holder of one of their Studentships, as an additional assistant at the Station. Mr. A. H. McKinstry, another assistant, has been given a year's study leave during which he is working at the School of Agriculture, Cambridge.

The existing accommodation at Gatooma is now proving rather limited, and the Government have undertaken to build another staff house, while the Corporation have purchased a site and built a house in Salisbury in which Mr. Cameron is living.

In view of the fact that cotton is being grown on a commercial scale this season, and that the industry is likely to expand, Mr. Cameron has been giving careful consideration to the question of improving the marketing of the crop. With this object, he arranged for Mr. Hesse, Manager of the Central Co-operative Cotton Exchange, Durban, to pay a visit to Rhodesia in order that he might tour the cotton-growing districts, and get into touch with the growers.

It would be unwise at the present time to attempt to estimate the potential output of cotton from Southern Rhodesia. It is hoped that the industry will expand, but not more quickly than the supply of improved seed, for it is

highly desirable that there should be no general growing of unsuitable seed, which can only eventually cause widespread disappointment. At present a great many farmers regard cotton solely as a rotation crop for maize : if it should subsequently be found to return as good, or even better, profits than that crop, the ratio of one crop to the other will be undoubtedly increased.

Now that the raising of a jassid-resistant variety appears to have been in a large measure achieved, the question as to how far cotton is likely to prove a profitable crop may largely depend on the severity and frequency of bollworm attacks, and the ability of the new selections to give paying crops in spite of them. It is thus to the breeding station at Gatooma that the farmers must again look for the production of a suitable early maturing and prolific variety.

So far, cotton has only been grown in three districts of the country, namely, Hartley, Lomagundi, and Mazoe, a fact due not so much to their special suitability to the crop, as to the fact that the farmers in those districts have shown a keener interest in it. If the industry flourishes in the districts named, it is quite probable that it will be taken up in other parts which are also climatically suitable, in which case the ultimate output of cotton from Southern Rhodesia would be considerable

As regards the current season, it is reported that rains arrived in good time for planting and continued up to Christmas, after which there was a dry period of about three weeks. Further rains fell in the second and third weeks of January, and were followed by three weeks of dry weather, which at the time when the report was written (February) threatened to develop into a drought. The cotton in most places was then sufficiently far advanced to be able to withstand drought conditions, though good rains would have been welcomed. It was feared, however, that if the drought continued, the maize crops would suffer severely.

Maize had already done badly, owing both to a dry season and to a severe attack of Army worm which destroyed wide areas of the crop. Re-planting was rendered difficult, owing to the drought, and it is feared that the yields will be only poor. Moreover, it is reported that the export price of maize had fallen below cost of production.

It is to be hoped that if in consequence the farmers turn to cotton as an alternative crop, they will exercise caution. The position is undoubtedly considerably better now than when they last took up cotton with an enthusiasm which somewhat outran their discretion in some cases. The prospects this season justify the belief that sufficient quantities of U.4 bulk seed grown at the Gatooma Station will be available to plant any acreage that is likely to be put under cotton next season, though there is not yet sufficient seed of the improved selections for general cultivation on a large scale.

Northern Rhodesia.

The First Annual Report of the Government Agricultural Experiment Station at Mazabuka has been received in the course of the past year, while, by kind permission of the Government, a more detailed account of the part of the work relating to cotton was included in the Corporation's annual volume of Reports received from Experiment Stations.

Three of the four members of the technical staff on the agricultural side of the Mazabuka Station were formerly either members of the staff of the Corporation or holders of Studentships. Mr. T. McEwen is the officer in charge of the Station, Mr. A. G. Bebbington, whose salary is paid by the Corporation, is Cotton Selection Officer, while Mr. W. Allan is Assistant Agricultural Officer, and specialises also on the entomological side of the work.

The season 1928–29 was the first in which staff was available to enable the many problems with which cotton cultivation in Northern Rhodesia abounds to be studied in any detail. It

has become clear that if cotton is to be again taken up as a crop by the farmers, a jassid-resistant variety must be provided, and this has been the problem upon which the staff of the Station have concentrated. It is gratifying to be able to report that the variety known as U.4, supplied from the Corporation's Cotton Breeding Station at Barberton, Transvaal, gives distinct promise of being able to withstand local conditions. It is accordingly being multiplied this season on the Station and by one or two farmers, while re-selection is being carried out on it by Mr. Bebbington.

The conditions last season were far from ideal, as the extreme newness of the land in the agricultural sense militated against heavy yields, while the crop also suffered from particularly heavy rains and hail storms in January of last year. Nevertheless, sufficient seed was produced to permit of 110 acres of this variety being planted in small trial plots and at various places throughout the Territory in the season 1929–30.

In the Report of the Department of Agriculture for 1928 acknowledgment is made of the assistance given by the Corporation, which is described as being of the greatest value, while the result of the experiments which are being carried out at Mazabuka is stated to be causing an increasing feeling of optimism that Northern Rhodesia may yet take her place among the cotton-growing countries of the Empire. The Secretary for Agriculture also pays tribute to the members of the Research Station staff and to the manner in which they have undertaken all kinds of duties other than those normally expected of them in order to overcome the many obstacles inevitable in the preliminary development stages.

Mr. Moffat, one of the Government Agricultural Officers, half of whose salary was defrayed by the Corporation, has now been absorbed into the establishment of the Agricultural Department, which has also been strengthened by the appointment of Mr. R. H. Fraser, a former holder of one of the Corporation's Studentships.

Mr. Moffat has been engaged in testing the possibilities of the Northern part of the country for cotton-growing, and although the results seem to show that the climatic conditions in the Abercorn district are unfavourable, it is satisfactory to note that in the area round about the shore of Lake Tanganyika, and in other parts, such as the Luangwa Valley, Luvu, and in the Isoka district, preliminary results are encouraging. Three varieties from the Corporation's Barberton Station, A.12, U.4, and Z.1, in particular are stated to have given specially promising results, although in one part of the area U.4 suffered rather severely from angular leaf spot. These varieties have, however, proved themselves as resistant to jassid in this area as in the many other parts of Africa in which they have been tried.

There appears to be evidence for thinking that the Luangwa soil and climate conditions will prove well suited to cotton. The temperatures during the growing season are also favourable, and if the crop is planted at the right time, there is an ample rainfall of 38 inches. The population is probably sufficient in number to make it worth while to develop cotton-growing, but there would be some 200 miles of road transport to Lake Tanganyika, and it also remains to be seen whether the economic needs of the natives would be sufficiently great to impel them to adopt a means of earning money which entails manual labour and demands a certain amount of application.

As regards the season 1929–30, the area under cotton is approximately 150 acres, 40 of which consist of experimental and bulk plots on the Central Research Station, Mazabuka. The remaining acreage consists of some twenty-two plots of five acres each, grown from seed of the variety U.4, which was distributed to farmers with a view to obtaining further information as to the behaviour of this strain. The plots cover the farming area from Livingstone to Lusaka, while in North–Eastern Rhodesia some small plots are also being grown.

The season has been one of abnormal climatic conditions up to the present. Planting was very much delayed by the fact that the first rains were late and that very heavy rain fell during the middle of December. January and February were both very dry, particularly the latter, during which there was a period of nineteen days when no rain fell. As a result, growth was slow and the plants were in some cases forced into somewhat premature flowering. The cotton generally did not suffer to any extent, particularly when compared with the maize crop which on some farms was seriously affected. The dry conditions also unfortunately detracted considerably from the value of the observation plots of cotton from the point of view of jassid resistance, while in addition, the extent of the jassid attack up to the end of March had been exceedingly small when compared with the same period during the 1928–29 season.

While it is too early yet to speak with confidence of the general prospects of cotton-growing in Northern Rhodesia, it is gratifying to learn that there has been some improvement in the agricultural situation as a whole.

This year again a further instalment has been repaid by farmers of the loan made jointly by the Government and the Corporation to assist those who had suffered severely from the disastrous season of 1925–26. The Corporation have now received a total of £3,940 out of £4,750 which was their half share of the original loan.

The Government are desirous of investigating certain problems relating to agricultural settlement, more especially on the suitability of the Territory for the settlement of small farmers without much capital. They have accordingly approached the Corporation through the Colonial Office to ask if they would allow Mr. Milligan to undertake the proposed investigation, a request to which the Corporation readily acceded.

Anglo-Egyptian Sudan.

The total output of cotton from the Sudan in the season 1928–29 reached the figure of 161,536 bales of 400 lbs., which is a record for the country. The Gezira produced over 110,000 bales, with an average of 3·54 kantars per feddan as compared with 3·3 kantars per feddan in the previous year, and the fact that this slightly higher yield was obtained from an increased area under cultivation renders it the more gratifying.

As regards areas under flood irrigation, the crop at Tokar exceeded 11,000 bales, but was slightly less than the quantity estimated. On the other hand, at Kassala 16,864 bales were produced, which was more than had been anticipated.

Last season for the first time the crop in the Sudan suffered somewhat severely from the disease known as Leaf-curl. The scientific staff are working energetically with the object of elucidating the cause of this disease, and the means whereby it is carried. While it is perhaps too soon to say that the responsibility can be attached to one insect alone, the latest reports indicate that sufficient evidence has been accumulated to show that White Fly is certainly largely responsible for transmitting the disease in the Sudan, as it has already been shown to be in those parts of Nigeria in which the same disease occurs.

The other principal disease from which cotton suffers in the Sudan is Blackarm, and further work that has been done in the past year has pointed to the desirability of planting cotton as late in the season as possible, as it has been established that the higher temperatures which then normally occur are unfavourable to the development of the disease. Both these problems were fully discussed at a meeting held in the autumn

of the London Supervisory Committee for the Co-ordination of Agricultural Research in the Sudan, with the help of the three technical assessors appointed by the Sudan Government. The several reports of research work and the programmes for the current session were also reviewed by that body, and are being published by the Sudan Government.

It is intended to add some 80,000 feddans to the area under cultivation in the Gezira. There is reason to believe, however, that this land is less fertile than the area already under cultivation, and if this proves correct, the yield of cotton to be expected from it must, therefore, be somewhat less. In recognition of this fact, the Government have arrived at an understanding with the Sudan Plantations Syndicate, whereby the Syndicate's share of the profits shall be on a sliding scale varying with the size of the crop. The Syndicate have also undertaken the irrigation by pump of a new area to the South of the present concession, which should give about another 500 feddans of cotton each year. The Kassala Cotton Company on the new area allotted to it by the Government in the Gezira has an area of over 15,500 feddans, from which a first crop of cotton is being picked this year.

The amount of cotton grown under rainfall showed a very gratifying increase from 4,630 bales in 1927–28 to 8,558 bales in 1928–29. In the present season, the areas in nearly all the provinces again show very substantial increases, and the Government estimate of rainfall cotton at the present time is over 14,000 bales.

The Director of Agriculture has kindly supplied the following note dealing with the present season's prospects:—

Sakel Type.—In the Gezira a total area of 174,183 feddans is this year under cotton. The anticipated crop is 376,754 kantars (315 rotls) representing an estimated yield over the whole area of 2·16 kantars per feddan.

For comparison the following table gives the areas and yields for the past four years since the Dam came into operation :—

Year.	Feddans.	Yield in kantars.(i)	Kantars per feddan. (ii)
1925–26 ..	80,301	384,642	4·79
1926–27 ..	100,057	477,272	4·77
1927–28 ..	105,587	374,973	3·29
1928–29 ..	131,531	466,168	3·54
1929–30 .. (estimated).	174,183	376,754	2·16

It will be seen from the above that this season's estimated yield per feddan is low. Various factors have contributed to bring this about. Heavy rains delayed sowing. Blackarm (*Bacterium Malvacearum*) was very prevalent and caused heavy damage : during the winter a long spell of cold weather retarded development. These factors have contributed to make the crop late. An outbreak of Egyptian Bollworm has also contributed to the loss. In general the present must be regarded as an unfavourable season.

Of the above total area under cotton this year, 158,585 feddans are handled by the Sudan Plantations Syndicate as Agents for the Government, while the Kassala Cotton Company similarly handle 15,598 feddans. The latest estimates for the respective areas for the present season are :—

	Feddans.	Yield in kantars.	Yield in kantars per feddan.
S.P.S. ..	158,585	317,170	2·00
K.C.C. ..	15,598	59,584	3·82

At Kassala, in the Gash Delta, the estimated crop is 100,000 kantars (315 rotls) and represents a record. Owing to a very good Gash flood, a large area of land was watered.

(i) 1 Feddan = 1·038 acre.
(ii) 1 Kantar = 315 Rotls seed cotton = 315 lbs. seed cotton estimated to give approximately for Sakellarides 95 lbs. lint, for American 89 lbs. lint.

Blackarm was in evidence, but in the Gash Delta has so far caused little damage as the plants seem able to grow away from the disease. Continued cold weather has delayed the crop, but prospects remain good.

The following shows the area and yield in the Gash Delta from 1925 :—

Year.	Area in feddans.	Yield in kantars.
1925	15,000	27,259
1926	11,400	22,533
1927	26,100	54,129
1928	25,840	65,980
1929	28,037	71,007
1930 .. .. (Estimated).	54,000	100,000

As previously, a large quantity of seed is being supplied from the Gash for sowing in the main Gezira Scheme.

At Tokar a good Baraka flood was experienced and a large area of land watered. In the early stages a very good crop was anticipated, but heavy damage was done by locusts and by strong dust-laden winds which frequently prevail in this district, whilst the cotton plant is still in the early stage. Again, for the last few years the waters of the Baraka have continued to spill further and further East to poorer land not yet covered by a layer of Baraka silt, also to low-lying, salty land towards the sea. As a result, the original estimate of some 60,000 kantars in the early stages has now been reduced to 41,300 kantars.

For comparison the following gives the approximate area watered and the total yield since 1925 :—

Year.	Area in feddans.	Yield in kantars.
1925	33,019	31,449
1926	14,400	10,777
1927	20,000	32,100
1928	45,000	53,454
1929	50,000	46,349
1930 .. .. .. (Estimated)	45,000	41,300

On private pumping estates the area irrigated is estimated at 4,000 feddans with an anticipated yield of 9,000 kantars. In addition, some 840 feddans are watered by Government pumping schemes with an estimated yield of 2,050 kantars. A point worth recording is the very high average yield obtained last season of rather over 7 kantars per feddan over an area of 221 feddans served by the newly erected Government pump at Dueim on the White Nile.

Summarised, the total estimated yield of Sakel cotton for the present season is 529,104 kantars, or 125,662 bales of 400 lbs.

		Kantars (315 rotls)
1.	Gezira Scheme :	
	Sudan Plantations Syndicate	317,170
	Kassala Cotton Company ..	59,584
2.	Gash Delta (Kassala) ..	100,000
3.	Tokar	41,300
4.	Private pumping estates	9,000
5.	Government pumps ..	2,050
	Total	529,104

Equivalent to 69,812 Egyptian bales (720 lbs. lint).

American type.—The total area of this type of cotton grown under irrigation this season is 17,650 feddans, and the estimated yield 51,820 kantars (11,530 bales of 400 lbs.).

As regards American-type cotton grown under rainfall from the Southern Provinces, which comprise Kordofan, Upper Nile and Mongalla, the estimated output is 57,975 kantars (12,900 bales of 400 lbs.). Progress continues to be very satisfactory in the Nuba Mountains area of Kordofan Province. In the Upper Nile output is more or less stationary : conditions for growth appear favourable, but the area is difficult of access, and the people seem hardly ready as yet to respond.

In Mongalla progress has been slower than originally anticipated. In certain areas conditions are fairly reasonable,

but elsewhere although growth is fair, a large amount of shedding takes place, with the result that the final output is disappointingly low. So far in such areas it is difficult to say what the reason is—whether soil, climate, or disease (*e.g.*, Blackarm). A theory recently put forward suggests that the heavy shedding may be due to shade effect. Several varieties and different dates of sowing have been tried under the guidance of the Corporation's Plant Breeder, and this year's results point to earlier sowing as beneficial. In the meantime we are marking time in the Yei locality until further investigations have been made.

For comparison, the following represents the output in kantars since this Southern rain-grown cotton scheme was initiated:

	1925	1926	1927	1928	1929	1930	(Estimated)
Kordofan (Nuba Mountains Area) ...	146	3,114	8,436	13,320	24,565	41,270	kantars.
Upper Nile ...	1,383	4,690	5,147	2,251	4,666	7,047	,,
Mongalla ...	268	5,075	5,519	3,907	5,892	9,658	,,
Total ...	1,797	12,879	19,102	19,478	35,123	57,975	,,

(N.B.—Kordofan includes old Nuba Mountains area. Upper Nile includes old Bahr el Ghazal area.)

From the Northern Provinces, comprising the Blue Nile, White Nile, Kassala and Fung Provinces, the estimated output for the present season of rain-grown cotton of American type is 6,115 kantars (1,360 bales of 400 lbs.).

In the first two mentioned provinces, generally speaking the rainfall is too light, and these are not regarded as of any importance for the production of rain cotton.

In the Southern area of Kassala Province, with the advent of the railway, native cultivators are again giving some attention to rain cotton. Here prospects are fair this season, and the anticipated output is some 4,000 kantars.

In the Fung Province native cultivators continue to show little interest in rain-grown cotton, but the South and East of this Province which is now being opened up is regarded as likely to afford a promising area for such cotton, *i.e.*, the stretch of country lying in the direction of Soda, Kurmuk, the Daga Valley and Nyeda. It is proposed to investigate this area in due course.

The total estimated output of American-type cotton for this season is therefore as follows :—

Irrigated American	..	51,820 kantars.
Rain-grown American	..	64,090 ,,
Total ..	..	115,910 ,,

Equivalent to 25,790 bales of 400 lbs. lint.

Summarised, the total estimated output of cotton from the Sudan for the present season is :—

Sakellarides	529,104 kantars	=69,812 Egyptian bales 720 lbs. lint.
American	115,910 kantars	=25,790 bales 400 lbs. lint.

Returned in bales of 400 lbs. for comparison with the crops from other countries in the table attached to this Report, the total estimated output is 151,452 bales.

The work of the Plant Breeding Section under Mr. Bailey has been influenced considerably by the prevalence of Leaf-curl disease. Unfortunately, many of the most promising hybrids that were being raised from Sea Island and Sakel stock have proved to be specially susceptible and have been abandoned. A large number of selections from amongst Sakel plants has been made, with the sole object of obtaining resistant strains. It seems, however, as if the property of resistance to the disease is better developed among the American type cottons than among those of the Egyptian type. It

may be mentioned that the variety U.4 supplied by the Corporation's Cotton Breeding Station in South Africa has shown resistance to the disease. Variety test plots have again been laid down in most of the rainfall cotton areas in the South, and these were visited by Mr. Bailey in December and January in the course of his visit to Uganda, to which reference is made later.

It is worth recording here that a promising variety of Sakel known as Sakel No. 186 has been bred up by the Corporation's Plant Breeder, as well as a variety of American of the Webber strain which has been given the name "Delrect," and which it is hoped will be found to be suited both for irrigated and rainfall land. Both varieties are now being tried out under field conditions.

Uganda.

Mention was made in this Report last year of the increase in the acreage under cotton in 1928–29 as compared with the previous season. The weather during the ripening period was generally favourable in all parts, and the resulting crop of over 204,000 bales constitutes a record for the Protectorate. The yield from Buganda Province of approximately 170 lbs. of lint per acre is particularly satisfactory, comparing as it does with a yield of barely 100 lbs. per acre from the Eastern Province. The latter figure was adversely affected by exceptionally heavy rains in Lango district, and by blackarm disease and the prevalence of stainers in parts of Teso.

In February 1929 the Uganda Government appointed a Commission to enquire into the cotton-growing industry, and their Report, which was issued in July last, contained many interesting conclusions and suggestions which have received the careful consideration of the local Government. Apart from recommendations as to methods of ascertaining each season what should be regarded as a fair price to be paid to the growers, the Commission advocated that a Board should be appointed

to decide which ginneries were redundant, and suggested lines upon which the Government might assist in encouraging the formation of Associations of ginners with due regard to the necessity for safeguarding native interests. With a view to the re-organisation of the ginneries and a reduction in their number if such Associations are formed, the Commission further suggested that a fund should be created to which the Government should contribute directly from the proceeds of the Cotton Tax, and the native indirectly by means of a small deduction from the price to be paid to him.

While the surplus capacity of the existing ginneries is unquestionably at the root of many of the difficulties confronting the industry in Uganda at the present time, the Corporation feel that the situation would be at all events greatly improved if means could be found whereby the yield of cotton per acre could be considerably increased. The Corporation believe that natural conditions in Uganda permit of such an increase in yield, provided that the native growers can be more fully instructed in improved methods of cultivation and induced to follow out those methods, and provided also that the Government maintain an effective control of the seed supply. They recognise that both these objects may necessitate a substantial increase in the staff of the Agricultural Department, and they have accordingly offered to defray the cost of two supplementary officers until such time as they can be absorbed into the regular establishment of the Department. An increase in the personnel should not only enable closer supervision to be given to the methods of cultivation employed, and to combating disease, but should permit also of the training of further native instructors to spread in the districts the agricultural knowledge they acquire in the Government schools. The offer of additional men has been accepted by the Uganda Government, and it is expected that two of the present holders of the Corporation's Studentships will proceed to Uganda on completion of their training.

The Corporation regard the effective control of the seed supply as no less important, and they welcome the announcement that a scheme has been worked out by the Government for such control in the Eastern Province. A segregated area has there been set apart consisting of 500–600 acres, where pure seed grown at Serere under the Cotton Botanist is to be multiplied for distribution in the following year. Further details of this scheme have been included by the courtesy of the Uganda Government in the Corporation's volume of Reports received from Experiment Stations, 1928–29 published in February last.

Supplementing the Government's action, the Corporation have offered to staff and run a similar seed farm for the supply of pure seed to Buganda Province. It was stated in last year's report that Mr. Bailey, the Corporation's plant breeder in the Sudan, would pay a visit to the Cotton Botanist in Uganda at the end of last year, and advantage was taken of this fact to ask him to go into questions arising out of the Corporation's seed farm proposal in consultation with the Director of Agriculture.

In his report, which has now been received, Mr. Bailey outlines a basis for co-operation between the Government and the Corporation in sharing the capital expenditure incurred in establishing the farm, while it is suggested that the Corporation should bear the whole cost of salaries and of the recurrent expenditure. Alternative sites have been inspected and the advantages and disadvantages of each compared. Mr. Bailey points out that no pure line of cotton has yet been tested at the botanical station at Bukalasa from which the seed farm would draw its seed for multiplication, so that it will necessarily take two or three years before a strain can be tested and produced in sufficient quantity for sowing the farm. In these circumstances the Corporation felt that as the matter is not immediately pressing, there was ample time to ascertain the Director of Agriculture's views on the report before taking action on it.

The relative advantages of the alternative sites will also be fully discussed with Mr. Bailey when he comes on leave this summer. The question of the staff that will be required is one of the matters that the Director proposes to discuss with Mr. Milligan, since it may be desirable to second an experienced member of the Corporation's staff from some other part of Africa for the first two or three seasons to get the farm started on the right lines. When the site has been selected and the preliminary arrangements made with the Government, it is hoped to make a start on the erection of buildings and on clearing the land, so that everything may be in readiness to start the actual farming operations as soon as seed is available.

At the Cotton Experiment Station at Serere work was carried out under some difficulty in 1928–29, owing to the very dry period from November onwards, which caused the plants to go off rapidly. Nevertheless, progress was made—notably in the multiplication of a selected strain which will be planted in the Government's segregated area in the Eastern Province referred to above.

Blackarm is reported to have done a considerable amount of damage at the Station, whilst stainers were also much in evidence. The apparent increase in the area affected by blackarm disease constitutes a disquieting feature in the record of the Uganda crop. Research work on blackarm is being vigorously prosecuted, especially in the Sudan, and it is hoped that it may suggest some means of controlling the disease or of mitigating the damage caused thereby which may be applicable to Uganda and other countries.

As regards the season 1929–30, the Director of Agriculture reports as follows :—

"The planting of the crop was delayed owing to dry weather during the early part of the season. The autumn rains continued right through to the end of the year with a slight break in November, and as a result of these conditions

planting continued later than usual. This compensated for the shortage of early sown cotton, and the total area planted amounted to 683,495 acres, compared with 699,107 for the previous season.

The continuance of the rains, whilst favouring late plantings, acted adversely on that portion of the crop which was already established, and the appearance of disease on the earlier sowings in the Eastern Province made the outlook less promising. Abnormally heavy rains during December and January retarded the ripening of the crop and caused considerable vegetative growth. In addition, the dull weather accompanied by low temperatures encouraged the rapid spread of blackarm disease, which was already very prevalent in the districts of Lango, Teso and Bugwere in the Eastern Province.

In Buganda Province the January rains caused considerable damage to the crop which was just reaching maturity at that time. A large percentage of the bolls failed to ripen and a considerable reduction in yield resulted.

Although the falling off in the area planted was negligible, for reasons stated above, there is every indication that the production for the season will show a very considerable decrease on that for the previous year, when the exports reached the record figure of 204,057 bales of 400 lbs. each."

Since the above was written estimates received by the Corporation give the probable crop as no more than 110,000 bales.

The extension of the railway from Jinja to Kampala proceeded during the year. The plate-laying was completed and the final connecting link between Kampala and the Coast, the Nile Bridge, is expected to be finished about the end of 1930. With the completion of this section, it will be possible to transport the greater portion of the cotton crop direct by rail to Mombasa, thus eliminating the damage by trans-shipment and consequent delays which were formerly experienced when it had to be carried across the Lake to Kisumu.

Tanganyika Territory.

In the season 1928–29 the rainfall was low in most provinces of the Territory, and in those areas in which the total amount for the season was adequate, the onset of the rains was belated. A general shortage of food crops was feared, but prospects improved in most parts as the season advanced, and the position in this respect was satisfactory at the end of the season in most districts. The cotton crop fell just short of 30,000 bales, about 3,500 bales less than in the previous season. The reports from the principal cotton-growing provinces were as follows :—

Mwanza.—The lateness of the rains caused a large proportion of the crop to be planted late. The position with regard to rainfall improved later in the season, but the total amount was insufficient to carry the crop to maturity before the effects of the dry season made themselves felt. The crop in consequence reached only 7,000 bales, as compared with 11,000 in the previous year. Increased agricultural staff and more demonstration farms and ploughing instruction have illustrated the value of this work more in this than in other provinces owing partly to the superior intelligence of the principal tribes.

Eastern Province.—Up to the end of April the crop prospects were excellent, but a drought followed, and the resulting crop was smaller than in 1928.

Tabora.—The season was generally similar to that experienced in Mwanza, and the crops were below normal.

Lindi.—The season was on the whole favourable and the cotton crop the best for many years. The chief increase in output was in the Mikindani District, and the Agricultural Department state that a pioneer ginnery in that area would be of great value.

The Agricultural Department has added a third Experiment Station, in Tabora Province, to those already established

at Morogoro and Mpanganya. Much valuable experimental work, including field experiments and selection work on cotton and rotation crops, is being carried out at these Stations. In addition, moreover, during the last two or three years agricultural sub-stations have been established which serve as demonstration farms and as centres at which seed tested by the Department can be multiplied under the supervision of a trained native agricultural instructor. This policy of extending crop production through the medium of native instructors who have served an apprenticeship under a District Agricultural Officer has given satisfactory results, more particularly since the establishment of the demonstration farms, which are financed from the funds of the local native administrations.

For the markets in the Morogoro-Kilosa area supervisors have been provided through a cess collected on all purchases of native seed cotton. The Agricultural Department state that the scheme has proved successful, and it is proposed to extend it to other areas.

Samples from most of the principal cotton-growing districts are forwarded to the Corporation each season by the Director of Agriculture for brokers' reports and spinning tests. Those of the 1928 crop were received and tested last year with satisfactory results. The staple length of most of the samples was reported as $1\frac{1}{8}$ ins. to $1\frac{3}{16}$ ins., while in the spinning tests the best samples were described as being capable of spinning 62's, while the worst were reported to give a good twist yarn at 50's.

At the time when this Report was written the 1930 season had barely opened, but the Director of Agriculture was able to say that the rainfall had been favourable for planting.

Nyasaland.

Cotton-growing developments in Nyasaland are highly gratifying. The crop in 1928-29 exceeded 6,000 bales, as compared with 4,470 in the previous year, and probably

nearly 90 per cent. of it was grown by natives in the Lower Shire area. Moreover, there are good reasons for hoping that the output will increase very considerably before long because (i) the good yields obtained from the strain produced at the Corporation's Station at Makwapala are inclining European planters to take up cotton again as a rotation to tobacco, (ii) the success of the strains produced and of the experiments on the best time of planting carried out at the Port Herald Station should lead to a very substantial increase in the average yield per acre in that area, and (iii) transport developments in the Protectorate will enable promising potential cotton-growing areas to be brought into cultivation, in which the growing of an export crop is at present economically impossible owing to lack of communications.

It may be of interest to expand somewhat the implications of these three factors. Firstly, for reasons explained fully in the volume of Reports received from Experiment Stations, the crop at Makwapala Station itself was poor, nevertheless one of the strains known as Over-the-Top, when grown outside the Station under better soil conditions, gave 400 lbs. seed cotton per acre, which is double the yield obtained at the Station itself. But the variety U.4, supplied by Mr. Parnell from Barberton yielded at the rate of nearly 600 lbs. per acre even on Makwapala soil, and if proportionately higher yields can be obtained from it elsewhere in the Shire Highlands, it should appeal to European planters as a remunerative crop in rotation with tobacco. In 1915 the area under cotton cultivated by Europeans was nearly 30,000 acres; in 1928 it was a little more than 1,000. If the new strain of cotton now available should ultimately lead to anything like the old acreage being grown by planters, the potential increase in output, especially taking into account the high-yielding quality of U.4, would clearly be considerable.

Secondly, in the Lower Shire area, where nearly the whole of the crop is grown at present, arrangements are being made

for multiplying strains resistant to jassid and to drought by means of a co-operative scheme on 4,000 acres of native gardens near the Port Herald Station. At the same time, extensive propaganda is being carried on to induce natives to plant within the limits of what has been ascertained to be the best time, and it is estimated that if successful, this alone might lead to a 50 per cent. increase in yield in this district.

Thirdly, it has long been recognised that Nyasaland's prosperity is dependent on improved communications with the sea, which, by enabling transport costs to be reduced, will render possible the development of export crops over an area not confined to the country adjacent to the present railway. It is understood that the construction of the Zambesi bridge and the extension of the railway to Lake Nyasa have now been decided on. So far as cotton is concerned, this will not only stimulate production in areas where it is already grown by enabling higher prices to be paid, but it should make it an economic crop in the area near the West shore of Lake Nyasa, where the soil is apparently quite suitable and the population adequate.

In this connection it may also be mentioned that in February last the Government withdrew the Order prohibiting cotton-growing in North Nyasa. This district had been closed to this crop since 1926 owing to pink bollworm having been reported there, and the consequent risk of spreading this pest to the cotton-growing districts in the South of the Protectorate in consignments of cotton passing through on their way to Beira. During the last two seasons no trace of the pest has been found in small test plots grown in North Nyasa under the superintendence of the Department of Agriculture, and the area has consequently now been re-opened for cotton-growing under certain regulations which it is hoped will prevent the spread of the pest to other parts should it recur in the district.

The small Experiment Station near Domira Bay, mentioned in last year's Report, has now been opened, and is being financed jointly by the Government and by the Corporation. The whole 30 acres have been planted with cotton this year with a view to ascertaining the degree of uniformity of the soil, but it will ultimately be used for the study of native food crops and other rotations as well as of cotton.

At the other two Stations, Makwapala and Port Herald, it has already been established that the best time for planting cotton is entirely different for each Station: at the former cotton is a winter, and at the latter a summer crop: though the Stations are only 150 miles apart, they differ considerably in altitude and in pest conditions. The first point, therefore, to be determined at the new Station at Domira Bay will be what is the best planting period. It is believed that the potential cotton-growing area in the vicinity of the Station is nearly three times as large as that around Port Herald on which nearly the whole of the present cotton crop of Nyasaland is produced.

The two tables given below, showing the output of cotton grown by natives in Nyasaland for the past 10 years, and the production by natives for the last 5 years divided into districts, may be of interest.

Native Production of Seed Cotton (Tons).

1920	315
1921	375
1922	392
1923	747
1924	1,369
1925	2,909
1926	2,197
1927	1,387
1928	2,486
1929	3,505

District.	1925.	1926.	1927.	1928.	1929.
1. Lower Shire ..	1,692	1,266	779	1,586	1,809
2. Chikwawa ..	454	571	352	680	1,248
3. Central Shire ..	153	165	147	120	195
4. Mlanje	85	89	25	10	14
5. Blantyre ..	—	25	24	18	10
6. Ncheu	99	34	16	14	47
7. Upper Shire ..	62	3	11	9	18
8. South Nyasa ..	142	12	4	1	18
9. Dedza	51	20	21	11	51
10. Dowa	12	12	8	37	95
11. Kotakota ..	1	—	—	—	—
12. Karonga.. ..	158	—	—	—	—
	2,909	2,197	1,387	2,486	3,505

In the first place it should be noted that the year 1923 marks the beginning of the period of the British Cotton Growing Association's buying agreement with the Nyasaland Government, from which time the increase in production is striking. The drop in production in 1927 was a reflection of the lower prices paid in the former season. From the second table it will be seen that the first two districts comprising the Lower Shire area and neighbourhood now produce nearly 90 per cent. of the total crop. This is almost entirely due to difficulties of transport in other areas. The increase from 220 tons in 1928 to 448 tons in 1929 in other districts is partly due to better average yields, resulting from the distribution of Over-the-Top seed raised by the Corporation.

Work on rotation crops has definitely indicated that cotton is an excellent rotation with tobacco; tepary beans seem to be a possibility as a third crop which would serve as a native food and as a catch crop for tobacco.

Mr. E. J. Wortley, who was Director of Agriculture from 1920–1929, was appointed last year to Trinidad. The Corporation are glad of this opportunity of recording their

appreciation of the whole-hearted and generous manner in which the Government have always co-operated with them in their work in Nyasaland, and of the assistance that Mr. Wortley has rendered in this connection.

Mr. Lawrence, a member of the Corporation's staff since 1926, was given a special Studentship by the Corporation last year, and on his return in October was taken over by the Government as a District Agricultural Officer in the Lower Shire District. The Director of Agriculture readily assented to a request by the Corporation that notwithstanding the transfer he should continue to supervise the Port Herald Station as part of his duties.

It was impossible at the period of the season (February) when the Report had to be sent off from Nyasaland, to make any attempt to assess the prospects of the coming crop. By far the greater part of the Nyasaland production is derived from cotton sown in March and April, and it is not until August when the effect of the late rains, if any, on the Lower Shire can be estimated that a provisional forecast can be made. Seed issues are reported to be well in excess of last year, which produced the record native crop, and on this score an increased production is to be expected. For the most part, the rains upcountry have been satisfactory, and an increase on last year is to be expected from all the early planting areas.

The Lower River areas had suffered from a shortage of rain, the latter part of January and early February having been exceptionally dry. Fortunately late in February the rains appeared to have set in again, and it is believed that satisfactory planting conditions were secured. According to reports received, given favourable planting and growth conditions, a considerable increase in production in the Chikwawa district of the Lower Shire was expected, provided that the late February rains mentioned above were sufficient and general over the whole district. Otherwise the lands

would not generally have a reserve water content to bring the cotton on, whilst the natives would have to resort to river margins and concentrate upon auxiliary food supplies.

A small increase in production on European estates was expected, mainly from cotton planted as a rotation crop with tobacco. A considerable acreage of cotton was also being grown by native tenants on various estates. Practically the whole European and native tenant acreage was sown with strains supplied by the Corporation. Of the general native crop, the main strain on the Lower Shire is still Nyasaland Upland, while most of the upcountry areas are sown with Over-the-Top from Makwapala.

Nigeria.

Satisfactory reports continue to be received from the Corporation's seed farm at Daudawa. It will be remembered that certain parts of the area originally allotted by the Government were found to be unsuitable for agricultural purposes: additional land has accordingly been placed at the Corporation's disposal, and extensions which will amount ultimately to a further 770 acres are now being undertaken. During last year 210 acres were cleared, thus completing the original block of 480 acres, which is now all under cultivation. In addition, a further 134 acres have been cleared since last July.

The 170 acres under cotton in the season 1928–29 gave a yield of 264 lbs. of seed cotton per acre. This result is less than was originally hoped for, and the reduction was due mainly to a somewhat severe attack of bollworm and to a less degree to the fact that two fields suffered also from leaf-curl disease. The total quantity of seed produced was 36,650 lbs., of which 34,960 lbs. were handed over to the Department of Agriculture for distribution, and the balance, which was not considered up to the standard required for this purpose, was used for cattle feed. The lint had an average staple of $1\frac{1}{8}$ ins.,

but was rather lacking in uniformity ; it was sold at 110 points on Middling American.

The problem of building up a permanent labour staff is most important at Daudawa, and it is satisfactory to be able to record steady progress in this direction. During the dry season it is impossible to take on all the labour available, but a plan is being tried of taking men on half time, or at a reduced rate of pay, in the hope that some of them at the end of the dry season may wish to remain permanently. The attractions are steady work, an ample supply of water, and a practically guaranteed supply of food. The gradual extension of the labour lines has improved the accommodation, and the whole of the water supply system has been reconstructed. The pipe line has been enlarged to enable water to be carried to all parts of the farm ; a supplementary steam engine and pump have been installed, and a water tower and storage tank erected. In this connection the Council are glad to record here their appreciation of the energy and resourcefulness shown by Mr. Browne and by Mr. Hutchinson in carrying out this work, which can hardly be described as a normal part of an agricultural officer's usual duties.

The number of farms in occupation alongside the seed farm itself has increased from 3 to 6. It will be remembered that these farms are worked on a co-operative basis, and 5 out of the 6 are at present occupied by ex-soldiers. Further farms are being cleared, and the houses are in course of construction. With the new pipe line it will now be possible for water to be brought into the centre of the Co-operative site, which should prove a great attraction, as formerly the tenants had to carry their water over half a mile. It is gratifying to be able to report that one of the three farmers last year obtained an average yield of 480 lbs. of seed cotton per acre.

In the season 1928–29, 350 acres were planted with cotton. Part of the planting was done by means of mechanical drills,

with a view to shortening the sowing season, as there was evidence that early planted crops did best. The seed rate used by the mechanical planters was quite moderate, amounting to about 16 lbs. per acre, and it is thought that this rate can be improved upon next season when certain improvements and adjustments have been made. The seed supplied from the Government farm at Maigana was a selection from Allens, and very favourable reports were given of it at the picking season, when the lint was described as being of good quality and staple, and freer from nep than that from last year's crop.

During the growing season some anxiety was felt owing to the appearance of jassid on the crop, and the Agricultural Department debated as to whether it might not be wiser to withhold the seed from this year's crop from distribution if it were of a type susceptible to this insect. The Director of Agriculture paid a visit to the farm, and it has been decided to distribute the seed in view of the fact that jassid was found to have done comparatively little damage, while the lint produced shows an advance in many respects on previous selections.

The most recent reports are that the farm is now free from tsetse fly, and it is accordingly intended tentatively to extend the use of cattle for cultivation purposes. In February there were five cattle working, and the Manager of the farm was about to purchase five or six more. No further experiments with mechanical cultivators have been carried out in the season 1929-30, as the tractors used last year were not in good condition, and it was thought undesirable to purchase others until the possibility of using cattle on a larger scale had been tested further.

The Director of Agriculture's estimate of the Nigerian crop for the season 1928–29, as contained in last year's Report, has proved to be extremely accurate as regards the Northern Province, and as regards the output of Ishan cotton. The

native cotton crop in the South, however, hardly came up to expectations; the price offered was reduced by ¼d. per lb. of seed cotton in May, and the Director estimates that this fact was the cause of the reduction from the estimated 10,000 bales to the actual figure of 6,501 bales from the South.

In the Northern Province the largest output now comes from the Katsina Emirate, with the Sokoto Province second. Development in the latter Province has been very rapid, and it is probable that the new railway which was opened for travelling on the 1st January, 1929, will pay its way even in its early days.

In his Annual Report for 1928, the Director of Agriculture referred to the discussion that had occurred as to whether the cheaper transport offered by the railway would lead to the replacement of cotton by groundnuts. He is of opinion that only extreme market changes would lead to any considerable replacement of the one crop by the other on its own soil, groundnuts being the crop for sandy soils and cotton for heavier ones.

The Government Botanical Department have been growing experimental plots of various cottons from India, the United States, and South Africa, the seed of which was obtained through the Corporation. So far none of the new strains seems superior to the selections from the Allen variety, which is that grown in the Northern Provinces. Nevertheless, single plant selections have been made from Hartsville, a variety obtained from the United States, and from A.12, U.4 and Z.1—all of which originated at the Corporation's Experiment Station at Barberton in the Transvaal. The improved Ishan variety, which is grown mainly in the district round Meko, is proving popular with the growers, and a very high percentage of the lint was classed as first grade in the season 1928–29, when about 1,000 bales were produced.

As regards the season 1929–30, in Northern Nigeria there was a considerable increase in the area planted, especially in the

Sokoto Province. The weather was, moreover, favourable in most districts, and the yield per acre was fully normal. In these circumstances, it is disappointing that the purchase price had to be reduced by stages throughout the buying season owing to the drop in the world price of cotton. The Director of Agriculture reported at the beginning of March that the anticipated purchases should slightly exceed 30,000 bales. Had the price been higher, there is every reason to suppose that the previous highest figure (37,000 bales in 1925–26) would have been exceeded.

In Southern Nigeria the season was about an average one for cotton. The improved Ishan cotton has done well, and although here too the low price and relatively small margin over " Native " cotton is disappointing and is bound to have an adverse effect, the Director considers that there is no reason to modify the previous estimate of an export of at least 3,000 bales. Owing to the low price, it is anticipated that very little ordinary " Native " cotton will be bought at all. Had it not been for the development by the Department of the Ishan cotton, very little cotton of any kind would have been purchased this season in Southern Nigeria, a new low record would undoubtedly have been established, and the cause of cotton-growing in the Southern Province would have suffered a great and possibly a fatal blow.

Gold Coast.

The Agricultural Department are continuing to carry out experimental work with cotton in two widely separated areas, namely, at Tamale in the Northern Territories, and in the Trans-Volta area.

At the Tamale Station, the yields were low last season, though better than in some previous seasons, and the Agricultural Department are now in a position to say that this result is due to excessive boll-shedding coupled with heavy insect damage. The cause of the excessive shedding is still the

subject of investigation. At the moment, the theory advanced is that it is due to poverty of the soil and excessive water-logging. In the surrounding district the average yield obtained is far below the limit at which cotton-growing becomes an economic possibility. It was mentioned in the Corporation's Annual Report last year that the Government paid a bonus of 10/- an acre for areas of cotton grown as a pure stand, and purchased the resulting seed cotton at 2d. per lb. The low yields obtained so far must have involved the Government in a loss, and the scheme has been suspended for the present. In the meantime, the activities of the Agricultural Department are concentrated on the production, if possible, of a high yielding strain which will be thoroughly tested on a large scale before extension work is undertaken. No great difficulty is anticipated in re-starting the crop if it can definitely be proved to be profitable.

The results of variety trials show that Ishan cotton from Nigeria compares favourably both with Allen's and with the native cotton as regards boll-shedding.

In the Trans-Volta area, a variety known as Sonko, which was originally introduced by the Germans, is being grown, as well as the indigenous variety. Though not such a heavy yielder, the former is stronger and has a longer staple than the latter. Experimental work, including variety testing, continues to be carried out at the Experiment Station at Kpeve, and it is interesting to note that there, as in the Northern Territories, Ishan cotton gave higher yields than local varieties. Trials have also been carried out to determine the best date of sowing, and tests on various cultural operations.

The power ginnery at Kpeve has effected a satisfactory speeding-up in the ginning, thus making seed available in ample time for the following planting season.

Sierra Leone.

It is unlikely that cotton will become an export crop of importance in Sierra Leone, at all events in the near future. It is nevertheless of interest to record that the Agricultural Department have been steadily pursuing during the last few years a policy of improving by selection the native Quande cotton. This course was adopted following on successive failures to obtain satisfactory crops from the seed of the American type grown in Northern Nigeria. The selection work on the Quande cotton has succeeded in producing plants from which the smoky-coloured lint, which was characteristic of much of the original material, has been eliminated. Moreover the selected plants show an increased lint length of $1\frac{1}{16}$ ins., while the yield per acre obtained from those plants shows a very marked improvement also. Reports received indicate, therefore, that definite progress has been made, though the selected plants are still far from being pure strains: it is proposed to continue the work on the same lines for the present.

Cotton stainers have always caused damage to the crop, and in some seasons the attack has been particularly severe. Any considerable extension of cotton-growing in Sierra Leone will consequently be dependent to some extent on the success of the measures that the Agricultural Department may find it possible to take to deal with this pest.

At the request of the Director of Agriculture, samples of seed of several varieties were sent for trial from the Corporation's Research Station, Trinidad. Unfortunately the excessive rainfall last season rendered it impossible to draw any conclusions as to their relative suitability to the local conditions.

West Indies.

In former reports attention has been directed to the advantages to the West Indian Islands that might be expected

if some form of effective co-operation could be devised between their several Departments of Agriculture, and last year reference was made to the decision to hold a Conference to discuss this matter. The Conference met in January last in Trinidad, under the Chairmanship of Mr. G. Evans, C.I.E. The several islands submitted their programmes of agricultural and veterinary research, which were examined with a view to preventing avoidable duplication while aiming at full co-ordination of effort.

So far as cotton is concerned, the principal islands are Montserrat, St. Vincent, St. Kitts, Nevis, Grenada, Antigua, Anguilla, and in some seasons Barbados, though the crop has lately been dropped in that island largely on account of the damage caused by pink bollworm.

In St. Vincent an important development last year was the decision taken by growers as the outcome of representations made by the Commissioner of Agriculture to change the planting date. In recent years the yields have been low, and this is believed to have been mainly due to the fact that the planting season hitherto adopted caused the bolls to develop and open in months in which the rainfall is heaviest, with resulting loss of much of the crop from fungoid and bacterial diseases. A fear was entertained that a later planting date might give rise to difficulty in the supply of labour and its use for other crops, but there is apparently ground for thinking that this can be overcome. The result of the change will be watched with much interest, and it is hoped that yields more satisfactory to the cultivators will be obtained in consequence. The change in the date for the opening of the planting season which has been agreed upon is from June 1st to September 1st.

In Montserrat the chief menace to the crop has been pink bollworm, and it is gratifying to learn that the work of the Agricultural Department has now established the fact that an earlier planting date will allow a second crop to be

harvested before the date by which the plants are required to be cleared in order to reduce the carryover of the pest. This change, combined with the results of the breeding work that has been carried on with a view to producing an early maturing variety, should considerably increase the yield. It is gratifying to be able to report that neither in Montserrat, Anguilla, St. Kitts, or Nevis was any appreciable damage done by pink bollworm in 1929, and only slight attacks of cotton worm were recorded. The absence of any severe attack of pink bollworm, and in fact the general absence of pests and diseases, was a characteristic of the 1929 season in nearly all the islands.

During the past two years reports have been received that the strains of Sea Island cotton in certain of the Islands have shown signs of deterioration. The Corporation decided to appoint an experienced cotton breeder to lay down the lines on which these strains could be maintained in a state of purity, but no suitable candidate for the post could be found.

In view of the latest reports concerning the deterioration of the St. Vincent strains, action is necessary at an early date, and a proposal alternative to the above has been adopted. It has been decided that Dr. Harland shall be allowed to carry out the duties of Cotton Adviser to the Imperial Department of Agriculture in the West Indies, in addition to his work at the Corporation's Research Station; and that the cotton station in St. Vincent, which was given up when the Research Station in Trinidad was started, shall be re-opened under a junior officer appointed by the Corporation taking his instructions from Dr. Harland. This latter proposal is contingent upon the St. Vincent Government agreeing to house the officer appointed and to bear the normal recurrent costs of the Station.

The following notes on the 1929 crop have kindly been supplied by the Imperial Commissioner of Agriculture :—

An outstanding feature of the year was the increased production in Montserrat, Antigua, St. Kitts, Nevis, and

Anguilla. There was a slight falling off in production in St. Vincent and Grenada.

Montserrat.—Weather conditions on the whole were favourable. There were no hurricanes or serious storms, but heavy rains in June and July caused a loss of some bolls, and gave rise to a fear that the crop would be adversely affected. Later reports were more favourable, and the final figures for the crop indicate a record yield per acre, as well as a record total output for the island.

St. Vincent.—The heavy rains in October and November, 1928, caused severe losses from boll disease, with the result that the crop was short and the yield per acre low. There was also a serious attack of cotton worm, and a slight attack of pink bollworm. Reference has been made above to the decision to make the planting date later, with a view to bringing the ripening season into the drier months of the year.

The reported deterioration in the quality of the St. Vincent cotton referred to above is now under investigation, with a view to ascertaining how far such deterioration has proceeded and what steps are possible to restore the St. Vincent strains to their former position in regard to quality and uniformity.

Antigua.—Returns are given showing a small crop of cotton : there were no returns from this island last year.

Anguilla : Nevis.—The production recorded for Anguilla and Nevis is high compared with the figures for recent years, and if the acreage returns can be accepted as fairly accurate, a very good average yield has been secured.

Barbados.—There are no figures of cotton production during 1929, as a close season of one year was maintained in that island, with the object of reducing the attacks of pink bollworm.

A table is given below showing the production in the season 1928–29 for the several islands. It may be added that in Montserrat and St. Kitts cotton is planted early in

the year, and the planting and reaping all fall within the same calendar year. It sometimes happens that the ginning of the crop is, however, not completed until after the end of the calendar year, as was the case with the crop harvested in 1929 in Montserrat, where a small quantity still remained to be ginned at the end of the year.

In Antigua, Nevis and St. Vincent, planting for the 1928–29 crop took place in the latter months of 1928, reaping occurring in the early part of 1929. In the islands in which Marie Galante cotton is grown, the crop figures represent cotton picked during 1929, this variety being a perennial. In Anguilla the rainfall is uncertain and the planting season varies, but the figures given are believed to be those for cotton reaped in 1929 :—

COTTON PRODUCTION FIGURES.

1928–29.

Island.	*Lbs. of Lint.*	
Grenada	251,664	
St. Vincent ..	263,772	Sea Island
	61,479	Marie Galante
Montserrat ..	700,000	(Estimated)
Antigua	69,886	
St. Kitts	336,181	
Nevis	406,916	
Anguilla	21,900	
	2,111,798	

= 5,279 bales of 400 lbs.

The prospect of an increased yield per acre of Sea Island cotton is of particular interest on account of its effect in reducing the cost of production. It is possible that the demand for this type of cotton may be stimulated if its selling price is reduced as a consequence of lower production costs. In this connection, on the invitation of the Empire Marketing Board,

Sir James Currie attended a Conference held in November last, at which the prospects of increasing the market for Sea Island cotton were discussed with Professor Todd on his return from a visit to the West Indies. It is understood that Professor Todd is making a special investigation of the present position from all aspects.

Ceylon.

The experimental work that has been carried out by the Agricultural Department during the past few years has established the fact that cotton is a valuable rotation crop in a system of agriculture suitable to the drier areas of Ceylon. Among the peasant farmers, however, shifting cultivation is the only form of agriculture practised in those parts of the island, and a system of crop rotation, which alone can establish cotton on a permanent basis, requires larger holdings and more secure titles of ownership of the land under cultivation. It remains to be seen whether any alterations along these lines in the conditions of land tenure will eventually follow as a consequence of the new system of internal government now being inaugurated.

Meantime, the work of the experiment stations is being directed towards establishing an early-maturing and jassid-resistant variety, while the stations serve also as demonstration farms in which cotton forms the principal money crop in the rotation. Work is also proceeding on suitable rotation crops.

Under the cotton purchase scheme in force, it has hitherto been the practice to buy cotton twice, namely, early in April and again towards the end of May ; a large proportion of the lint offered at the first sale is immature, and the Department of Agriculture in their last Report referred to the desirability of having only one sale, presumably in May, with a view to securing an improvement in the quality of the lint.

Cyprus.

There was a slight increase in the area under cotton in 1929 as compared with 1928, and the production showed an increase from 2,146 to 3,610 bales. This increase was due to the favourable rains in June and favourable climatic conditions in July for irrigated and early sown unirrigated cottons.

The heavy and continuous rains experienced during the months of December, January and February last, caused flooding of the low lying lands, thus making available a greater area for summer crops, and it was anticipated that much of this available land would be planted to cotton. When this Report was written (March) preparations were already being made for the planting of unirrigated cotton. With the early sowing of both irrigated and unirrigated land, and given favourable conditions during the growing period, the prospects for the cotton crop in the coming season were regarded as better than they had been for many years.

Every endeavour is being made to get farmers to plant their cotton earlier than has been the practice hitherto in order to obviate much of the loss and damage caused by the pink bollworm. Variety trials are being made this year, and although many applications are being received by the Agricultural Department for freshly imported seed, no large quantities are being imported until more definite information is available as to the varieties best suited to Cyprus conditions. It may be found necessary to bring the issue and use of seed under Government control.

Since it is recognised that any expansion of agriculture in Cyprus is dependent on water and irrigation, no great improvements or developments in cotton production are anticipated until some of the important irrigation schemes under consideration by the Government are carried out. In this connection experiments and trials will be conducted at the Central

Experiment Farm that it is proposed to establish in the Morphou Bay area.

Fiji.

The future of cotton-growing in Fiji must still be regarded as uncertain; nevertheless, the Corporation decided last year, at the request of the Government, to renew for a further three years the contract of Mr. Anson, their Cotton Specialist.

It was felt that it would be inopportune to transfer him elsewhere at the present time, seeing that he has been engaged with every prospect of success in developing a type of cotton suited to Fijian conditions, that will be assured of a wider market than Sea Island, and that will be as profitable to the cultivators because its higher yield per acre will compensate for its lower intrinsic value.

Mr. Anson's work last season centred on the multiplication of the progeny of two selections of Kidney cotton, the seed of which was originally collected by Mr. Evans in New Guinea. By selection work the "kidney" characteristic, viz. seeds which adhere together and thus make ginning difficult, has been eliminated, and the seeds from the two selections which are being multiplied are separate. The yields obtained at the Experiment Station last season were extremely encouraging, while the two strains showed, moreover, wonderful resistance to exceedingly wet conditions. Seed was issued last season to a few growers living in a valley where it could not be contaminated by any other variety, and there it showed also an ability to recover completely and rapidly from a severe attack of jassid. The two selections from which samples were sent home were valued at 200–250 points on, while the spinning tests results were also promising. The Government purchased the crop at a guaranteed price, as they did the Sea Island crop, but it is probable that, starting with the 1929–30 crop, they will revert to their former practice of making an advance to growers, followed by a deferred payment not exceeding 50 per

cent. of the advance, when the crop has been sold ; any balance accruing would be placed to a reserve fund to be drawn upon in years when the advance at the guaranteed price led to a net loss.

The area in which Sea Island cotton was grown last season was limited practically to the West Coast of the main Island. Continuous rains and cloudy weather severely damaged the crop, and eventually heavy storms of wind and rain washed out about half of what remained. The total crop, therefore, will, it is feared, be very much reduced. Further selection work is being continued by Mr. Anson in order to keep this variety up to type.

The season 1929–30 has so far proved disastrous both to the Experiment Station crops and those in the district. The worst " blow " for many years was experienced in December, and lasted for two days, during which time nine inches of rain fell. Most of the seed cotton harvested from the selections grown in the previous season was lost, while the whole of the 1929–30 crop which had just germinated was destroyed. Seed for re-sowing was distributed free, sufficient for about 400 acres. Moreover, the previous season's crop was at least two months later than usual, owing to that season having been exceptionally wet, and in the district near the Station only part had consequently then been harvested. Between 800 and 1,000 bags of seed cotton were reported to have been either blown off the trees or carried away by the flood. Other crops also suffered equally severely.

Research.

Research Station, Trinidad.—The Corporation have accepted with much regret the resignation of Dr. E. J. Maskell, Assistant Physiologist, who has been obliged for family reasons to resign his appointment and return to live in England. The value of Dr. Maskell's work is reflected in the papers published jointly with Dr. Mason, to which he contributed

his full share, while he has also kindly assisted the holders of the Corporation's Studentships at the Trinidad College in some of their advanced studies, particularly in statistics as applied to agricultural problems.

Dr. E. Phillis, formerly on the staff of the John Innes Horticultural Institution, Merton, has been appointed to succeed Dr. Maskell. The authorities of the Shirley Institute kindly gave permission for him to spend a few weeks there before going to Trinidad, in order that he might familiarise himself with the technique employed by them in certain physical and chemical determinations in connection with the cotton hair.

Accounts of the work that has been carried out during the past year in the Physiology Department and the Genetics Department respectively, as supplied by the Heads of the Department, are given below.

The Research Station Committee have had several meetings of considerable interest. As announced in the Report last year, Professor Engledow, who visited the Imperial College of Tropical Agriculture on behalf of the Empire Marketing Board, was requested by the Corporation to take the opportunity to visit their Cotton Research Station also, and report to them on the work that is being carried out. It has been arranged that Professor Engledow shall report verbally to the Corporation, as it will be easier for him to give a general description of the scope and progress of the work in this way without going into technical details. He has already attended a meeting of the Research Station Committee, of which he is a member, at which the whole question of the policy of the Station was fully discussed in the light of his visit. The policy laid down by the Executive Committee when the Station was established was that it was intended to prosecute fundamental research work at the Station, even if its objects might appear to be remote from immediate practical application, on the ground that if it were possible thereby to ascertain the

fundamental scientific facts regarding the cotton plant, the conditions governing its growth and the processes by which its lint was formed, such research must ultimately lead to information that would find an economic application. The Research Station Committee re-affirmed this view after hearing Professor Engledow's report, and expressed their appreciation of the quality of the work that was being done.

It was stated in this Report last year that the physiological work of the Station had already been of assistance to the botanists in the Sudan in the work which they were carrying out on Blackarm. It will doubtless interest members to know that the Director of the Shirley Institute considers that this same work may also throw light on the causes of "neppiness" in cotton, and has expressed the opinion that improvement in the quality of cotton, irrespective of staple length, and information of value to the finishing trade, are practical results to which this work may quite possibly lead.

The Research Station Committee have also had interesting meetings with both Dr. Mason and Dr. Harland, at which they have discussed with them in detail their results and their research programmes.

The Committee regard it of great importance that as close connection as possible should be secured and maintained between the Research Station in Trinidad and the Corporation's several Experiment Stations in Africa. With this object, they have, in the first place, arranged that the Heads of the two Departments should prepare a commentary on the annual volume of Reports received from Experiment Stations, considered from the physiological and genetic points of view respectively. It is hoped that a conspectus of the reports from these standpoints may bring to light relationships between sets of experiments at different Stations which might otherwise be overlooked, while perhaps suggesting also possible explanations of phenomena recorded in the reports, the causes of which the workers themselves have not had time to investigate fully.

In addition, at Mr. Milligan's request, the Executive Committee arranged for Dr. Harland, Head of the Genetics Department, to pay a visit to South Africa and Southern Rhodesia, where he is at the present time. It is believed that he will find it of the greatest help to his work to meet the members of the Corporation's staff at the Barberton and Gatooma Stations, and it is further hoped that he may be able so to plan his scheme of research work at Trinidad as to give it a direct bearing on the fundamental principles underlying some of the problems that have arisen at the several Experiment Stations.

A further suggestion by the Research Station Committee, which has been adopted by the Executive Committee, is that a meeting shall be held at the Shirley Institute, immediately following the International Botanical Congress to be held at Cambridge in August next, which shall be attended by any members of the Corporation's staff who are on leave at the time. It is hoped that in addition to Dr. Mason from Trinidad, several members of the staff in Africa may be available. Research institutions in this country are also being invited to send to that meeting any members of their staffs who may be working on allied botanical problems, while the Colonial Office has been informed that any members of the scientific staffs of cotton-growing countries who may be on leave would also be welcome. A similar invitation has been sent to the Sudan Government and to the Imperial College of Tropical Agriculture. It is believed that such a meeting at which members of the Corporation's staff can discuss their work with others who have had somewhat different, but cognate, experience, will be of mutual benefit, and do much to remove the feeling of scientific isolation which is almost inevitable in a small, tropical research or experiment Station.

The Heads of the two Departments report as follows on the year's work.

Physiology Department.—During the year, a number of papers on the Transport of Nitrogen have appeared in the Annals of Botany. The first three of these have been collected and issued by the Corporation in a publication constituting the second Memoir of the Physiology Department of the Station. Further contributions on this subject will appear in the Annals during 1930. They will subsequently be issued together as a third Memoir. These papers will be followed by others dealing with the movement and storage of other elements in the cotton plant.

" This line of work promises to develop in an interesting way. As a result of it, we foresee the possibility of using the chemical composition of the plant as an indicator of the nutritional status of the soil. Stated very briefly, we find that an element, such as potassium, has at times a greater concentration at the apex than at the base of the stem, while at other times the reverse obtains. This change in the direction of the potassium gradient appears to depend on the potassium supply at the disposal of the plant. Whether further work will substantiate this tentative suggestion, we cannot of course say, but we are planning experiments to test it out.

" Our first paper on boll shedding should also appear shortly. We have found that the first symptom preparatory to shedding is a limitation in the uptake of carbohydrate by boll and pedicel. This occurs some 4 or 5 days before shedding. A day or so before the completion of abscission, a change occurs in the acidity of the sap. Why a limitation in the uptake of carbohydrates should be followed by a change in sap acidity is not yet clear. Contrary to the generally accepted view, there does not appear to be any grounds for the view that a water shortage in boll and pedicel is the primary stimulus for abscission.

" Recently the idea has been advanced that the electrical conductivity of the leaf sap might prove a useful indicator of the suitability of strains of cotton to saline conditions. So

far as our observations go, it appears that the electrical conductivity of the sap depends on a number of very obscure factors, and it seems doubtful, until a great deal more is known about the subject, whether it can be of much practical utility. A paper on this subject will also appear in the near future."

It will be seen that the general line that is being followed in the work is to trace the means by which the plant food is transported through the plant and delivered to the boll, where it forms cellulose.

Genetics Department.—Dr. Harland's report on the year's work is as follows :—

"Studies of inheritance in both New and Old World cottons have been continued. The crosses which have previously been referred to between *Gossypium tomentosum* (the wild species from Hawaii) and Upland are being studied in detail. Our principal economic aim in this case is to elucidate the mode of inheritance of the hairiness of *tomentosum*, with the object of transferring it to Upland varieties. The effect of this may be greatly to modify the reaction of Upland cotton to drought conditions.

"Three further papers constituting the second Memoir of the Genetics Department are shortly to be published. One of these papers deals with correlation of hair characters in various parts of the plant, and it is shown that replacement of the factor for fuzzy seeds by its naked allelomorph results in a loss in the amount of lint per seed of about 25 per cent. The other two papers deal respectively with the inheritance of seed fuzz and with anthocyanin pigmentation.

"The new type of big bolled Upland cotton with a weight of lint of over 10 grammes per 100 seeds is maintaining its purity, and will shortly be ready for extended trial.

"A large number of crosses are being studied. This work is mostly routine, and has to be got out of the way preparatory to more intensive studies of economic characters. We have concentrated on inter-Upland crosses this year, as the results of inter-specific crosses are complicated by the phenomenon of "blending inheritance," which we have shown to be due to segregation of modifying factors. If crosses are made between nearly related types, segregation is more apt to be clear and straightforward.

"Papers on the inheritance of chlorophyll deficiency, leaf shape and crinkled dwarf rogue are being written up."

Dr. Harland was desirous of adding to his collection of cottons by obtaining seed from Mexico, Salvador, Guatemala, Honduras and Costa Rica. At the request of the Corporation, the Foreign Office very kindly asked the British Legations in those countries to do their best to obtain the seed as desired, and the warm thanks of the Corporation are due both to the Foreign Office and to the officials of the several Legations concerned for the trouble they have so kindly taken in rendering it possible for the Corporation to comply with Dr. Harland's request. The seed received was in all cases treated by heat and fumigated, by the courtesy of Dr. J. W. Munro, at the Biological Field Station of the Imperial College of Science and Technology.

Experiment Stations.—The reports received from the several experiment stations on the work of the year 1928–29 were issued in February as usual. In addition to the Stations whose reports were included last year, we have to thank the Government of Northern Rhodesia for permission to include a section dealing with the work that has been done on cotton at the Government Agricultural Station at Mazabuka. The Uganda Government also again gave leave for the report of the Station at Serere to be included in the Corporation's volume.

To facilitate a general survey of the work that is being done, and of the chief directions in which progress is being made, each report begins with a summary by its author in which he sets out briefly the principal results that have been secured and any special difficulties that have been encountered. In addition, Dr. J. C. Willis, F.R.S., has again written a preface in which he makes a general review of the position and indicates the lines upon which the work has advanced. As he says, the feature of the year with regard to the breeding work is unquestionably the success which attended the growth of the variety known as U.4, which was first selected by Mr. Parnell, the Corporation's plant breeder in South Africa, and which is already in process of improvement by further selection work, not only in South Africa, but in Northern and Southern Rhodesia and in Nyasaland.

Dr. Willis also calls attention to the important problem of discovering in each country a suitable crop rotation of which cotton will constitute one member. He emphasises the need for keeping the soil in good condition, and for ensuring that the food drawn from it by the several crops is taken at a fairly evenly balanced rate having regard to its actual constitution. The investigational work that is being carried out is, therefore, directed towards discovering what are the actual food requirements of the several crops in a rotation, with a view to ensuring that a sequence shall be devised in which the successive crops are sufficiently distinct in their demands to obviate the risk of soil exhaustion.

The task of converting African natives to a system of scientific farming is naturally not without its difficulties ; these are in themselves not entirely agricultural, but have their origins in such matters as systems of land tenure and native customs. Nevertheless, the Corporation are convinced that it is only by establishing cotton in a properly systematised scheme

of farming that its cultivation can be promoted and the industry built up from sure foundations.

Home Universities and Institutions—Cambridge University. This is the ninth year in which Cambridge has received holders of the Corporation's Studentships for further training. In the first year they were two in number ; in the present year there are five, while the total for the whole period is thirty-seven. The lead which the Corporation gave in awarding scholarships for the training of men for tropical appointments has now been followed by the Colonial Office. As a result, one of the most important sections of the rapidly growing post-graduate side of the School of Agriculture has come to be the Colonial section. Including scholars of the Corporation, of the Colonial Office, and of the Ministry of Agriculture, and certain scholars from the Dominions, there is a post-graduate section numbering nearly 40. This does not, of course, include post-graduates specially engaged in research for the Ph.D. Degree or other purposes.

It is thought that members of the Corporation will be interested in the following account of the course of training that has been evolved by the University for men who are destined for tropical posts connected with agriculture and the allied sciences.

The men of what may be called the Colonial section are of several types. Some have a degree in Agriculture and are to become agricultural officers in the Colonies : the second increasingly important type consists of men with an honours degree in pure science who have decided to turn over to practical agriculture : in a third main group are men with an honours degree in pure science who wish to become specialist officers, *e.g.*, entomologists, mycologists, etc. The men in these groups, coming from a number of different Universities and with varied objectives before them, have presented a large and somewhat difficult problem in training. As their numbers are now so

large, however, it has been possible to provide special advanced courses.

The essential objects of the training are simple. The scholar who is to become an agricultural officer must have a sound knowledge of the fundamentals of agricultural practice, coupled with a scientific basis for the understanding and application of these practices ; and similarly the probationary specialist, while he must be trained to a high degree in his special subject, must have that basis of practical knowledge which will enable him to co-operate with the practical agriculturist and fit him to apply scientific knowledge to the problems of the field.

The special advanced lecture courses include, among other things, Tropical Building Construction (undertaken at the request of the Imperial College of Tropical Agriculture, Trinidad) ; Surveying ; methods of conducting variety and other trials, including the recently devised techniques and procedures ; Genetics, in so far as this is required by the agricultural officer, *e.g.*, in raising and handling pure stocks of cotton seed. General agricultural botany and agricultural economics, etc. are also included. In connection with the lectures, special post-graduate excursions to various types of soil and farming in the Eastern Counties are arranged. In Soil Science particular attention is given to drainage, alkalinity of soil, irrigation, and other questions of wide tropical importance. The Corporation's scholars spend a period of two to three weeks at the Shirley Institute, Didsbury, for study of the properties of the cotton fibre, and to gain some insight into manufacturing processes.

Two special features of the system of training may be mentioned. In the Tropics, particularly where cotton or other new crops are being introduced, every officer, however practical his work may be, is bound to be an experimentalist, for very much yet remains to be found out about the growing of even

existing crops. Now experimentation on a field scale as distinct from the scale of the small experimental plot or laboratory, is a highly difficult and specialised subject. Every post-graduate of the types referred to in this account is, therefore, required to take part in a field scale investigation. He is encouraged to estimate his own requirements in skilled and unskilled labour, in land, and in monetary outlay. He is also responsible, with assistance, for the statistical handling of the data.

The second feature of the scheme is personal supervision. There is a Director of Advanced Students who takes responsibility for general guidance and welfare. In addition, every scholar has as his personal supervisor and technical guide, some member of the teaching or research staff of the School of Agriculture.

Manchester University.—At the University of Manchester, experiments were carried out to ascertain the effect of various kinds of soil and various dates of sowing on the susceptibility of the cotton plant to the attacks of thrips. Experiments were also made in the same direction with variations in temperature and humidity to which the plants were subjected. This work is being continued.

In the Mycological Department several fungal parasites of the cotton plant were cultivated in the laboratory to determine the conditions under which the several kinds of spores which they produce are formed. The susceptibility of the parasitic organism to changes of temperature was also investigated.

The literature on cotton mycology and cotton entomology is being carefully collected and studied by the investigators, and from both Departments research work has been published on cotton pests in the Annals of Applied Biology and in the Transactions of the British Mycological Society respectively. A demonstration by a member of the staff has also been given on diseases of the cotton plant, to an interested audience of

cotton operatives at Nelson. In this way it was thought that some of the work of the Corporation could be brought to the notice of those dependent for their livelihood upon an abundant supply of cotton.

Imperial College of Science and Technology.—The recent work of the Biology Department of the College, which is of most interest to the Corporation, deals with the sterilisation of seeds and the testing of the viability of seeds. Considerable work has been done on the most satisfactory method of ridding seeds of insect infestation. Hydrocyanic acid gas is most widely employed at present, but some risk is attached to its use on account of its high toxicity. Other cheap and toxic fumigants are available, but they are highly inflammable. The best non-inflammable and non-explosive fumigants are carbon tetrachloride and trichlorethylene. By themselves, however, these substances are not very efficient, so experiments are being conducted in which these are mixed with others such as carbon disulphide, ethyl acetate, etc. Such tests now in progress should render a wider range of fumigants available and make fumigation a safer operation and, it is hoped, a cheaper one.

A number of consignments of cotton seed from various countries have been sterilised at the request of the Corporation. the method used being a combined treatment with heat and with hydrocyanic acid.

Tests are being conducted of a possible method of determining the viability of cotton seed by the use of a solution of a dye. It is well known that many dye solutions are rapidly taken up by dead plant tissues but fail to stain living tissues. It has been claimed that by means of a dye like indigo carmine, a test of the number of viable seeds in a sample can be made in a few hours, instead of the days required for a germination test. If the outer coating of the seed be broken so that the embryos are exposed to the dye solution, the living ones remain

uncoloured while the dead ones are deeply stained. This method is being studied, a careful comparison being made between the results of such a test and an ordinary germination test. Such a test, however, though it may give information rapidly as to the number of living seeds in a sample, can hardly give information as to germination vigour.

Rothamsted Experimental Station.—Several Departments are engaged on work directly bearing on problems of cotton cultivation. Dr. Keen and the staff of the Physics Department have been studying rotary methods of cultivation, which if successful would greatly simplify the work of cotton-growing by producing a seed bed in one operation and maintaining the land easily and relatively inexpensively in clean condition. Although in any particular region the final test must always be on the land itself, these investigations will save the overseas worker much preliminary labour by showing the lines on which the tests are best carried out and the kind of effects that should be looked for. Rotary cultivation does not produce a very fine tilth, but it leaves the seed bed in a loose condition that encourages early germination of the seed and rapid growth of the young plant. Later on, however, the effect ceases and the subsequent stages of growth are no better, and may even be worse, than on land cultivated in the usual way.

Investigations are proceeding on the deterioration of soil resulting from saline or alkaline conditions to which many cotton areas are liable.

Dr. Fisher and the staff of the Statistical Department have helped a number of experimenters dealing with the cotton crop in designing their field trials and interpreting the results : they have also demonstrated to certain officers on leave suitable methods for applying tests of the statistical significance of results.

In the Chemical Department, Dr. E. M. Crowther and his staff have studied certain analytical difficulties encountered with samples of tropical soils. The standard methods not infrequently break down with these soils, and search is being made for the causes, with special reference to the determination of acidity, alkalinity and mechanical analysis, which are of importance in formulating advice on problems of manuring and cultivation. The increased use of some of the newer fertilisers, such as cyanamide, has necessitated renewed attention to the problems of nitrification in the field to which reference was made in last year's Report. In addition, work is in progress on the decomposition and utilisation of green manures and crop residues.

In the Department of Mycology, Mr. R. H. Stoughton is studying the Blackarm or Angular Leaf Spot disease of cotton. The work falls under two main heads, (i) the influence of environmental conditions on the disease, (ii) the life history of the bacterium responsible. The studies on climatic factors are being carried out in specially designed chambers in which plants can be grown under controlled conditions. Air temperature has a considerable influence on the amount of disease developing on seedlings, but soil temperature plays a less important part than had been supposed by other workers. This investigation is being made in close co-operation with workers in the cotton-growing countries of the Empire. Studies on the behaviour of the organisms in culture have revealed new phases in its life history, which may prove to be of considerable importance in the persistence and spread of the disease. In particular, it has been found that the bacterium can change, apparently suddenly, in several of its characters, and that one or more of the new forms so produced may be innocuous, while later these non-virulent types may revert to the destructive form. The Empire Marketing Board provided the funds for the erection and maintenance of the rather costly equipment needed for this investigation.

The numbers of officers and visitors from cotton areas visiting Rothamsted in the past year have again increased. Most of them have brought some special problem to discuss with the appropriate members of the staff.

Studentships.

Last year, the Corporation reduced the maximum number of Studentships offered to ten, without, however, causing thereby any decrease in the number of applications received. Although this fact can be accepted as evidence that the Studentships are regarded as providing an avenue to an attractive career, the circumstance that nearly 60 per cent. of the applicants were also candidates for the Colonial Office Agricultural Scholarships calls attention to the limited field from which cadets for agricultural or specialist posts abroad can be drawn. It is consequently fortunate that the close co-operation which exists between the Corporation and those departments of the Colonial Office which are responsible for the selection of men for these awards obviates competition between the two bodies.

The four holders of Junior Studentships in 1928–29 were confirmed for a second year, while four new Students were appointed under the new regulations to Studentships which are tenable for two years, subject to satisfactory reports at the end of the first year's work. In addition, a special Studentship, tenable for one year at the School of Agriculture, Cambridge, was awarded to Mr. A. H. McKinstry, a member of the Corporation's staff in Southern Rhodesia, who was recommended for study leave.

Of the holders of Studentships who completed their training in 1929, two received appointments on the Corporation's staff: Mr. R. L. Knight was appointed Assistant to Mr. Bailey, the Corporation's Plant Breeder in the Sudan, his former Assistant, Mr. Kenchington, who had also held one of the Corporation's Studentships, having received an

appointment under the Sudan Government. Mr. A. N. Prentice was appointed as Second Assistant at the Cotton Breeding Station, Gatooma, Southern Rhodesia, where the satisfactory progress made an increase in staff desirable.

Four of the remaining five men who also completed their training last year have received appointments in the Colonial Agricultural Services: Mr. C. W. L. Fishlock in Uganda, Mr. R. H. Fraser in Northern Rhodesia, Mr. C. W. Lynn in the Gold Coast, and Mr. R. H. Turner in Nigeria. The remaining man, Mr. A. Pickles, has been appointed Entomologist to the Froghopper Investigation Committee of the Imperial College of Tropical Agriculture, Trinidad.

Spinning Tests.

Over 150 samples have been received during the past year for broker's reports, and of these, spinning tests were asked for on 112. Nearly all the principal cotton-growing countries are represented, including the Sudan, South Africa, Rhodesia, Uganda, Tanganyika, Nigeria and Ceylon.

The Sudan samples were again of both Egyptian and American-type cottons. They included special Egyptian-type strains grown in breeding plots and variety tests, together with samples from a " Date of Sowing " experiment with Sakel, which is an important point in relation to susceptibility to Blackarm.

The American-type cottons included those from the variety tests which are being carried out to determine the best kind for growing under pump irrigation and rainfall respectively, as well as a set of samples in duplicate to enable conclusions to be drawn as to the effects of saw ginning and roller ginning.

The South African and Rhodesian samples consisted of selections from the jassid-resistant variety, U.4, and were sent with a view to ascertaining whether the new selections are superior to the original bulk in commercial properties.

The Corporation desire again to thank on their own behalf and on behalf of the Agricultural Departments of cotton-growing countries all those who have co-operated in carrying out these tests and preparing the reports on the samples. These include firms of brokers and the staff of the Liverpool Cotton Association, the spinners who have kindly allowed these tests to be carried out in their mills or in their Experimental Department, and those members of their staffs and of the staff of the Shirley Institute whose skill and experience have been brought to bear on this work.

The announcement that the Shirley Institute are erecting new buildings for machinery designed to carry out spinning tests on small samples is particularly welcome. The assistance which such tests can give to the plant breeder is not perhaps generally recognised. Admittedly there is only one real test of the commercial value of a cotton and that is its behaviour in actual practice on a commercial scale—incidentally it may be mentioned that even that does not enable a value to be placed on a new cotton until it has been in use long enough for the mills to learn how to handle it so that it gives the best results of which it is capable. But the plant breeder desires to know whether his work is proceeding on the right lines in the early stages—perhaps when no more than 5–10 lbs. of lint from his selected plants are available; and in order that he may not waste both time and land in multiplying up to a commercial quantity a cotton which may ultimately prove not to possess the desired spinning properties. He realises that tests on such small quantities cannot be as serviceable or informative as commercial tests, but they do afford a very valuable indication of the progress that is being made, provided that the tests are carried out under conditions that are strictly comparable from one year to another.

It is precisely in this respect that the tests as hitherto carried out have often been lacking. So far, the Shirley Institute, in making arrangements for such tests on behalf of

the Corporation, have had to rely on the kindness of those spinners who are good enough to submit to the inconvenience and bear the cost of spinning these small samples. The generosity and public spirit of these firms is fully recognised, but it is inevitable that comparisons of the results of tests made in different years on similar cottons, but under conditions which must of necessity vary to meet the requirements of the mill in which they are conducted, are apt to provide data from which the plant breeder frequently finds it by no means easy to decide whether or not he is making progress towards improvement in the spinning properties of the type of cotton he is endeavouring to produce. Thus, for example, samples are at present necessarily spun in whatever conditions are prevailing at the time when they are received in the mill which kindly consents to make the test : they must, therefore, generally be spun against a control consisting of whatever mixing is then in use, and to the counts at which the machinery of the mill is set at the time. It is practically impossible to estimate the full spinning value of the sample under such conditions, which may well be entirely different in the following year when samples of the same strain are received representing a year's further selection work on the part of the plant breeder : actually it is not even always convenient or possible to have the samples of the two years tested in the same mill.

The significance of the proposed development at the Shirley Institute will, therefore, be realised ; the change will be from often uncontrollable and varying conditions in different mills where the scope of the tests is necessarily inadequate, to the controlled, reproducible conditions of a scientific laboratory where sufficiently extensive tests can be carried out on machinery designed and equipped primarily for experimental work, in an atmosphere of which the temperature and humidity conditions can be rigorously controlled and varied at will, and under conditions that permit of the control being selected solely with a view to its being that most appropriate to the sample.

Moreover, the provision of facilities for carrying out the tests at different counts and twist constants in order ultimately to determine those with which the sample under test gives the best results will place the work on a proper scientific basis. Furthermore, when these conditions have been determined, they can be repeated when similar cottons are received for test in successive years.

It may be appropriate here to ask Directors of Agriculture to assure themselves that in the case of every sample sent for test, there are definite advantages to be derived at that stage from the information that the spinning test may be expected to supply, so that the number of samples submitted is not larger than necessary. In the earlier stages of plant breeding, the various selections in the plant breeder's hands may sometimes be so variable in their field properties (*e.g.* yield, habit, time taken to reach maturity, etc.) that small differences in lint properties are of less account. As work goes on, the plant breeder will himself eliminate some types that are definitely undesirable, while at this stage the small-scale spinning test and broker's report may be helpful in further reducing the number of strains to be carried to a subsequent stage. Later on, strains are likely to become so nearly equal in the field that lint characters assume greater importance. By that time, however, the urgency for putting out an improved strain is often considerably less than it had been one or two seasons before, so that it is possible to postpone sending further samples until sufficient lint is available for large-scale tests of spinning quality. The conduct and supervision of spinning tests, whether they are carried out on experimental machinery designed for the purpose, or in a commercial mill, cost money to, and make a considerable demand on the time of, those who are kind enough to undertake them.

Transport.

In view of the fact that for some years the Corporation carried out pioneer work involving experiments and investi-

gations in problems of improved mechanical transport, members will doubtless be interested to be kept in touch with the work that is now being done on this subject through the Oversea Mechanical Transport Directing Committee that was appointed by the Secretary of State for the Colonies at the end of 1928. Sir James Currie, who is Chairman of this Committee, reports that good progress is being made and that the Committee are chiefly engaged upon the evolution of two units which are intended to handle heavier useful loads than are possible with standard vehicles as at present designed without causing excessive wear on unmetalled roads.

The smaller unit is designed to carry a load of 15 tons, and will consist of a tractor and two large, or a greater number of small, trailers, all mounted on wheels. The axle loads will not exceed three tons, so as to prevent undue wear to the road surface. After the preliminary tests have been carried out with a petrol engine, it is intended that a heavy-oil engine shall be installed, so as to take advantage of this cheaper type of fuel. The tractor is now being manufactured and an eight-wheel trailer, which will carry a load of $7\frac{1}{2}$ tons, has come through its tests satisfactorily. This trailer is fitted with mechanical braking and steering gear. A second trailer of somewhat different design, but carrying the same load, is on order to complete the unit.

The larger unit is to handle a useful load of about 40 tons, and will be mounted on tracks. This unit is still in the design stage, as the problems presented are more complex than are those involved in the case of the smaller unit.

In view of the great importance which attaches to the improvement of transport facilities in the several cotton-growing countries if the areas which are suitable to this crop as regards both soil and climate are to be fully developed, members will follow with great interest the valuable work that the Committee have in hand.

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EMPIRE COTTON CROPS FOR YEARS 1919-29, EXCLUDING INDIA.

IN BALES OF 400 lbs.

The seasons are given as covering two years (*e.g.*, 1926–1927) because in the majority of the countries named planting takes place in one calendar year and picking in the next. In a few of these countries, however (*e.g.*, Tanganyika, Iraq, Cyprus, Malta), the crop is harvested in the same year as that in which it is planted. In such cases the figures should be read as relating to the crop grown in the *latter* of the two years at the head of the column.*

Country.	1918–19.	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.
(1) Anglo-Egyptian Sudan	15,997	23,160	30,519	24,074	28,306	47,652	44,912	121,131	148,118	126,115	161,536 (1)
(2) Gold Coast	52	—	61	49	15	93	1,132	1,218	285	264	148 (2)
(3) Nigeria..	17,500	16,200	30,000	15,096	16,811	25,694	39,137	47,909	27,464	20,930	32,126 (3)
(4) Uganda..	36,530	47,694	81,365	48,290	88,046	128,604	196,038	180,859	131,728	138,486	204,057 (4)
(5) Kenya	100	100	500	417	1,200	1,653	2,250	2,046	1,232	1,241	1,984 (5)
(6) Nyasaland	2,591	2,026	4,615	5,422	4,036	6,873	7,718	4,976	2,792	4,470	6,095 (6)
(7) Northern Rhodesia ..	56	35	100	80	102	500	379	506	32	17	— (7)
(8) Southern Rhodesia ..	—	—	—	—	—	1,650	4,907	6,803	639	90	280 (8)
(9) Tanganyika	—	—	7,327	7,175	11,434	18,793	21,724	24,280	15,966	32,965	29,454 (9)
(10) Union of South Africa and Swaziland ..	1,911	2,737	2,923	2,740	6,523	8,730	16,936	20,381	10,242	11,013	9,774 (10)
(11) West Indies	6,361	5,787	4,763	4,314	5,295	4,309	4,186	5,941	6,076	4,321	5,308 (11)
(12) Queensland	31	38	792	3,140	9,344	11,850	14,318	7,179	5,880	10,266	6,296 (12)
(13) Cyprus	3,325	2,687	2,547	1,505	2,233	3,397	3,320	4,614	2,110	2,146	3,610 (13)
(14) Malta	343	266	582	193	118	573	782	507	342	541	379 (14)
(15) Iraq	—	60	60	300	1,100	2,400	2,540	3,500	1,800	5,200	4,700 (15)
(16) Fiji	—	—	—	—	—	83	153	120	797	124	298 (16)
(17) Ceylon	—	—	—	—	49	324	121	261	186	202	376 (17)
	84,797	100,790	166,154	112,795	174,612	263,178	360,553	432,231	355,689	358,391	466,421
		Percentage Increase 18·8.	*Percentage Increase* 64·8.	*Percentage Decrease* 32·1.	*Percentage Increase* 54·8.	*Percentage Increase* 50·7.	*Percentage Increase* 36·9.	*Percentage Increase* 19·8.	*Percentage Decrease* 17·7.	*Percentage Increase* 0·7.	*Percentage Increase* 30·2.

* The adoption of this practice for the purpose of giving consistency to the records has necessitated the transference of the figures for certain countries to a previous column. The totals in this table will consequently be found to differ slightly from those previously published.